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An investigation of the creep characteristics of Portland cement mortar under static and dynamic strain

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AN INVESTIGATION OF THE CREEP CHARACTERISTICS OF PORTLAND CEMENT MORTAR UNDER STATIC AND DYNAMIC STRAIN

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has been conducted in accordance with the regulations of the Graduate School. The undersigned, appointed to conduct this examination, agree that the candidate has successfully passed this examination.

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ABSTRACT

The combined effect of static and dynamic loads on design of underground openings is currently receiving much attention. It is known that the time-dependent behavior of rock is considerably different when a dynamic load is superimposed on prestressed rock. The shape of an underground opening has a definite influence on the magnitude of the local stresses and these may be significantly larger than those due to the weight of the overlying rock alone. Under these conditions, even a small dynamic load in the form of vibrations caused by blasting, drilling and related operations may increase the stress beyond a critical value. Dynamic tests in the laboratory are much more involved than static tests, and it is very useful to determine the relationships that exist between the static and dynamic creep.

This dissertation presents the results of an investigation of the creep behavior of mortar under simultaneous static and dynamic stress. Two types of dynamic loads were applied in the form of a cyclic stress of low frequency: (1) an excitation load and (2) a cyclic load linearly additive to the static load.

Based on the static creep behavior of mortar, a mathematical analysis for the dynamic loading conditions is presented. A comparison is made between the experimental results and the mathematical predictions. Finally a mathematical model is presented which best fits the dynamic creep behavior of mortar.

ACKNOWLEDGMENTS

The author wishes to express his gratitude first to his wife for without her patience and sacrifices this dissertation would not have been possible.

He is especially indebted to Dr. George B. Clark, his dissertation supervisor, for his confidence, encouragement and guidance for the past two years. Thanks are given to Dr. James J. Scott for his counsel and encouragement.

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LIST OF SYMBOLS

A = elastic element

B = viscous element

C = capacitance

D = partial derivative with time

E = modulus of elasticity

$\overset{*}{E}$ = complex elastic modulus

e = base of natural logarithms

F = Fourier transforms

f = frequency

i = current

k = constant

L = Laplace transform

L^{-1} = inverse Laplace transform

$\overset{*}{M}$ = complex modulus

P = linear differential operator

q = charge

R = resistance

s = generalized Laplace frequency

ss = subscript for steady state

T = period

t = time

V = voltage

$\overset{*}{Z}$ = electrical impedance relating to current

$\tilde{Z}^*$ = electrical impedance relating to charge

ε = strain

ε^* = transform of strain

ε_o = strain at zero time

$\dot{\varepsilon}_o$ = initial rate of strain

ε_{ss} = steady state strain

ε_{tr} = transient strain

$\dot{\varepsilon}_{tr}$ = transient rate of strain

η = coefficient of viscosity

Σ = summation

σ = stress

σ^* = transform of stress

τ_m = relaxation time

τ_k = retardation time

ϕ = phase angle

ω = circular frequency

α = infinity

σ_a = alternating stress

σ_e = equivalent static stress

σ_o, σ_s = constant static stress

a, c_1, a_1 = constants

β = time index

α_o = stress index at zero time

α_1 = stress index in transient state

α_2 = stress index in steady state

E'' = ratio of the static stress and equivalent static stress

V'' = ratio of alternating stress and equivalent static stress

η_m = coefficient of viscosity for Maxwell model

η_v = coefficient of viscosity for Voigt model

λ = viscoelastic coefficient for Burger's model

$E(jw)$ = complex Young's modulus in frequency domain

CHAPTER I

INTRODUCTION

One of the most important problems in design of underground openings is the evaluation of strength characteristics of rocks.

The conditions which govern the stability of the underground structures are modified when dynamic loads are present in addition to static loads. A structure which would be stable for a long period of time under a static load may not be so under a combined dynamic and static stress.

Considerable work has been done in the field of static rock mechanics in recent years. However, there has been practically no work done in determining the response of rock materials to combined loading conditions.

In underground openings rocks are seldom under static loads alone due to continuous mining activity. They are quite often under dual static and dynamic forces. The design criteria if based solely on the static load conditions could give erroneous results, therefore, a better understanding of the complex behavior of rocks is necessary to evaluate the parameters correctly. The static time-dependdent properties of rocks can be determined relatively easily, whereas the dynamic properties are more difficult to obtain. Once the relationships between the static and dynamic creep

properties have been determined, it is possible for many materials to predict the dynamic behavior from the results of experimental work done under static loading conditions only.

The purpose of this investigation was to determine the dynamic creep characteristics of mortar on a suitably designed testing machine, in which a specimen could be subjected to simultaneous static and dynamic stresses. The two types of dynamic loads were sinusoidal in nature and were applied by means of different sized eccentrics rotated at various speeds. Temperature was held constant throughout the experiment.

Analytical results based on mathematical analysis compared favorably with the experimental results. The dynamic behavior of mortar may be expressed in terms of a mechanical model, whose viscoelastic coefficients are determined in the frequency domain. The results of the analytical analyses for selected cases are shown in Appendix D. Conclusions on dynamic response of mortar and recommendations for further research are given for several aspects of dynamic creep of rocks.

CHAPTER II

LITERATURE SURVEY

The published literature in rheological studies related to creep can be divided into two categories, i.e.,

I. Creep under Static Loads.

II. Creep under Dynamic Loads.

Creep under Static Loads.

Considerable research work has been done in the past decade with metals, and many empirical and phenomenological rules have been postulated on their strain-time behavior. Several theories have been presented which predict the creep behavior of metals on an atomic or molecular scale.

The success with which the behavior of various metals has been described theoretically is dependent on the fact that almost all metals show well organized crystal systems and they are not heterogeneous in nature. This approach, therefore, cannot be applied rigidly to geological materials which are basically heterogeneous.

One of the first attempts to study the time-dependent behavior of rocks was made by Griggs (9), (10), (11) who demonstrated that rocks in general exhibit creep before ultimate failure. The creep behavior of limestone under uniaxial and triaxial loads is expressed in an empirical equation in the form:

$$S = A + B \log t + Ct$$

where S = percent strain, A, B, and C are constants depending upon the material and t is time. Although an empirical equation is convenient for analyzing the data, it does not add enough basic information to the understanding of strain-time process.

The phenomenological approach has therefore been used by several authors for expressing the behavior of some geologic materials. The response of these materials is described in terms of a combination of simple physical models. Strain-time studies on ice by Jellinek and Brill (13) and on plastics by Darling (6) indicate that the creep behavior of these materials appears to follow Burger's model. This model (Appendix A) consists of a series combination of two basic units, the Maxwell unit (an elastic and viscous element in series) with a Kelvin or Voigt unit (an elastic and viscous element in parallel). Hardy (12) suggested the possibility of using a modified Burger's model to predict the creep behavior of Steep Rock iron ore, which he studied by loading the specimens under a constant stress of 2022 psi.

Creep under Dynamic loads.

The dynamic behavior of materials has been receiving more attention in recent years. The creep response of metals under static tensile or compressive loads is known to be different than under a dynamic or dual dynamic and static load. In the field of metals Lazan (15), (16) determined the effects of a superimposed sinusoidal cyclic tensile stress on the creep of an aluminum wire under static tensile load at

room temperature. The results indicated that the low magnitude cyclic stress (lowest or trough stress was 55% of the highest or crest stress) caused a larger first stage total creep, an earlier commencement of second state total creep and a lower second stage creep rate than that produced by a static load equal to the highest or crest value of dynamic load.

Shuji Taira (22), (23), (24) using the approach of Lazan (15) conducted experiments on dynamic compression and tensile creep properties of various types of low carbon steels. He concluded that the dynamic creep and rupture properties of these steels could be predicted with reasonable accuracy from the static creep and rupture test data. Using the concept of equivalent static stress (a stress which will produce the same creep as a combination of dynamic and static stress), he showed that the theoretical analysis compared favorably with the experimental results for the transient state of creep.

For geologic materials, some research has been presented which describes the dynamic behavior of materials in terms of physical models. Terry (25) and Ross (21) established that the Burger's model holds for the behavior of coal and concrete respectively even under the conditions of some types of dynamic loading. Terry (25), while testing the mechanical properties of coal, showed that a simple Burger's model with single retardation time gives only an approximate description of coal's mechanical properties. Using a composite oscillator method, he found that at frequencies of 5-90 kc the material

exhibited a spectrum of retardation times which increased rapidly with decreasing frequencies. He postulated the application of a number of Kelvin or Voigt units in series with a Maxwell unit for a more accurate prediction of dynamic creep behavior of coal.

CHAPTER III

LABORATORY INVESTIGATION

Equipment.

The special equipment designed for the purpose of this investigation consisted of the following units.

I. Hydraulically operated Static Loading Device

II. Static Loading Unit for Dynamic Creep Testing Machine

III. Dynamic Creep Testing Machine

Control Room.

A specially constructed temperature, humidity controlled room was used in which the temperature was kept at 72-75° Fahrenheit and the humidity remained between 35% to 37%. The inside of the room was insulated with 2-inch fiber glass enclosed in aluminum foil and was equipped with shielded wiring to minimize the effects of static pickup by the oscillograph.

Hydraulically Operated Static Loading Device.

For comparison of the results of static and two types of dynamic loadings a hydraulically operated static loading frame (Figure 1) was used. It consisted of a 20 ton capacity hydraulic jack mounted on a steel frame with loading head of the jack seated in a collar of a movable 1 inch thick slotted steel plate of 5-3/4 inches height. A 10,000 psi bourdon type pressure gage was mounted on the pressurized chamber of the hydraulic jack and was calibrated with Tinius-Olsen

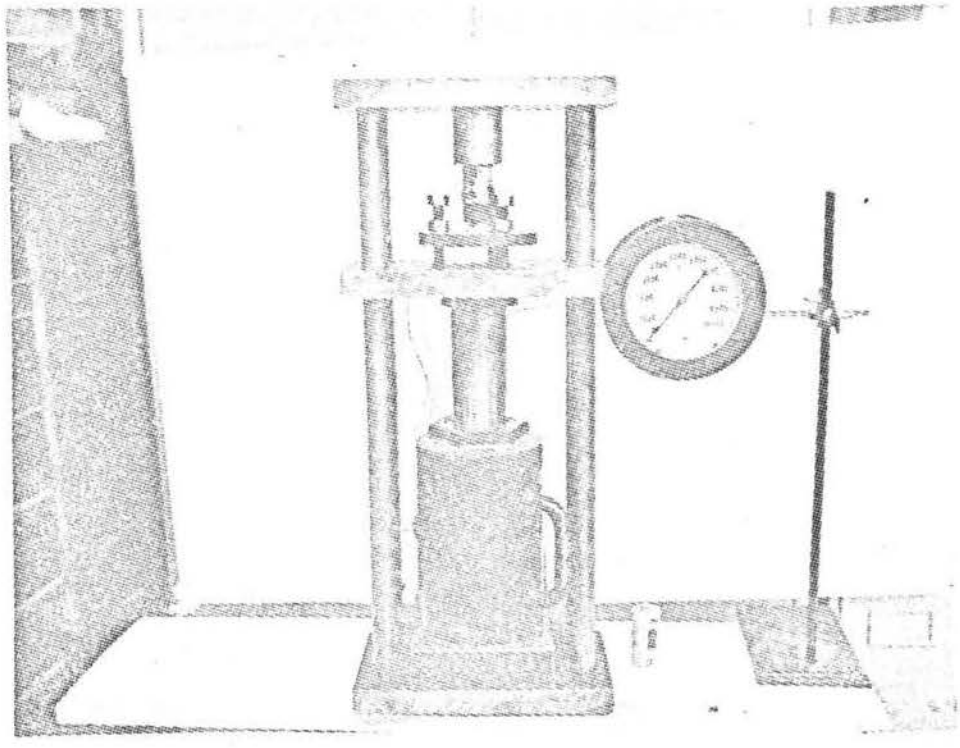

Figure 1. Hydraulically Operated Static Loading Device.

universal testing machine. The calibration curve (Figure 2) of the 10,000 psi pressure gage is essentially a straight line.

The specimen with the two SR-4 type 5-A gages mounted longitudinally was placed between the upper two plates of the frame and a zero load null balance was obtained on a Hathaway strain indicator. A static load was then applied and readings were taken from the strain indicator at various times. The experiment was continued until a steady state strain was obtained.

Static Loading Unit.

The static loading unit (Figure 3) was designed to give a preload to the specimen undergoing dynamic testing. It consisted of two 1-inch thick and 12-inch square mild steel plates separated by 4-3/4 inch coil springs. Each of the four springs was kept in position by means of three pins in the bottom plate. Four 1/2-inch diameter steel bolts of nine inches in length were passed through the middle of the springs and through both plates to keep the springs compressed at desired static load. Another set of two 5/16-inch diameter bolts of 10 inch length were fixed on the opposite sides of the plates to record the static load level at all times.

The fine adjustment base plate with the specimen on it, was placed on the upper plate of the static loading unit. This unit was calibrated (Figure 4) against the Tinius-Olsen universal testing machine up to a maximum of 8,500 pounds load.

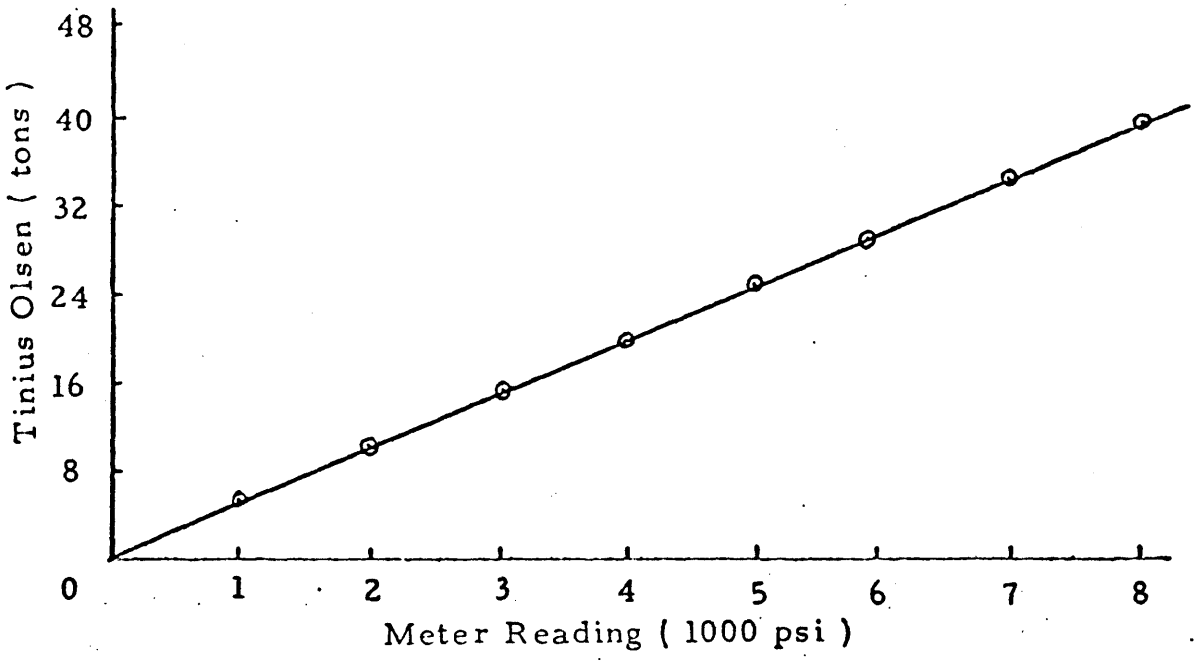

Figure 2. Calibration Curve of 10,000 psi Gage with the Applied Load of the Hydraulic Jack.

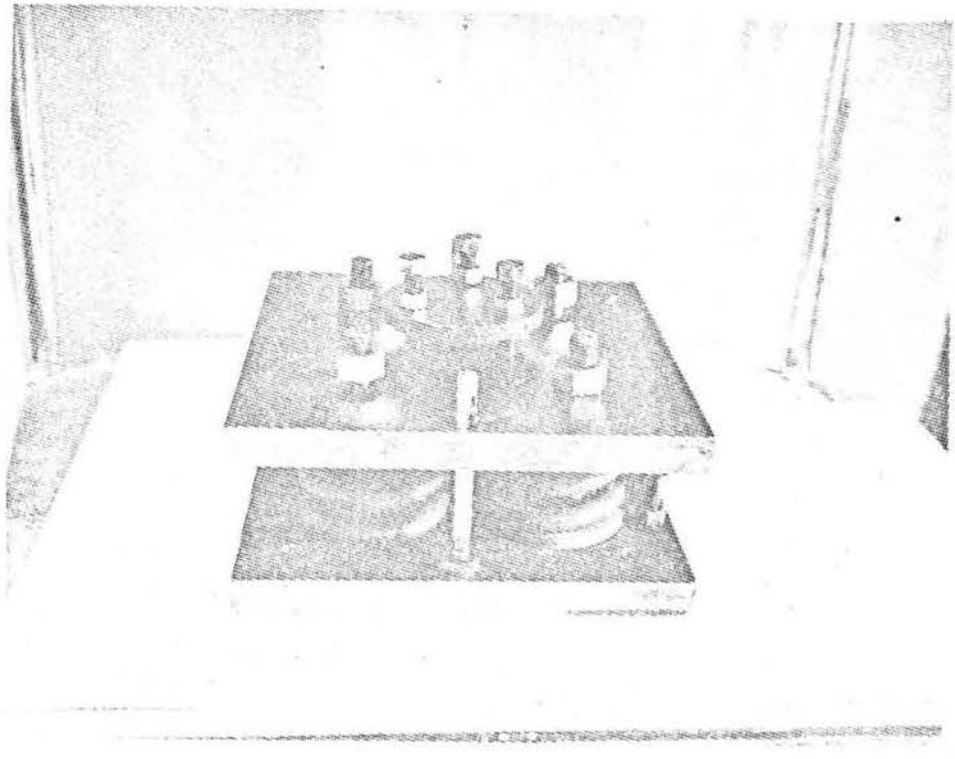

Figure 3. Static Loading Device Used in the Dynamic Creep Testing Machine

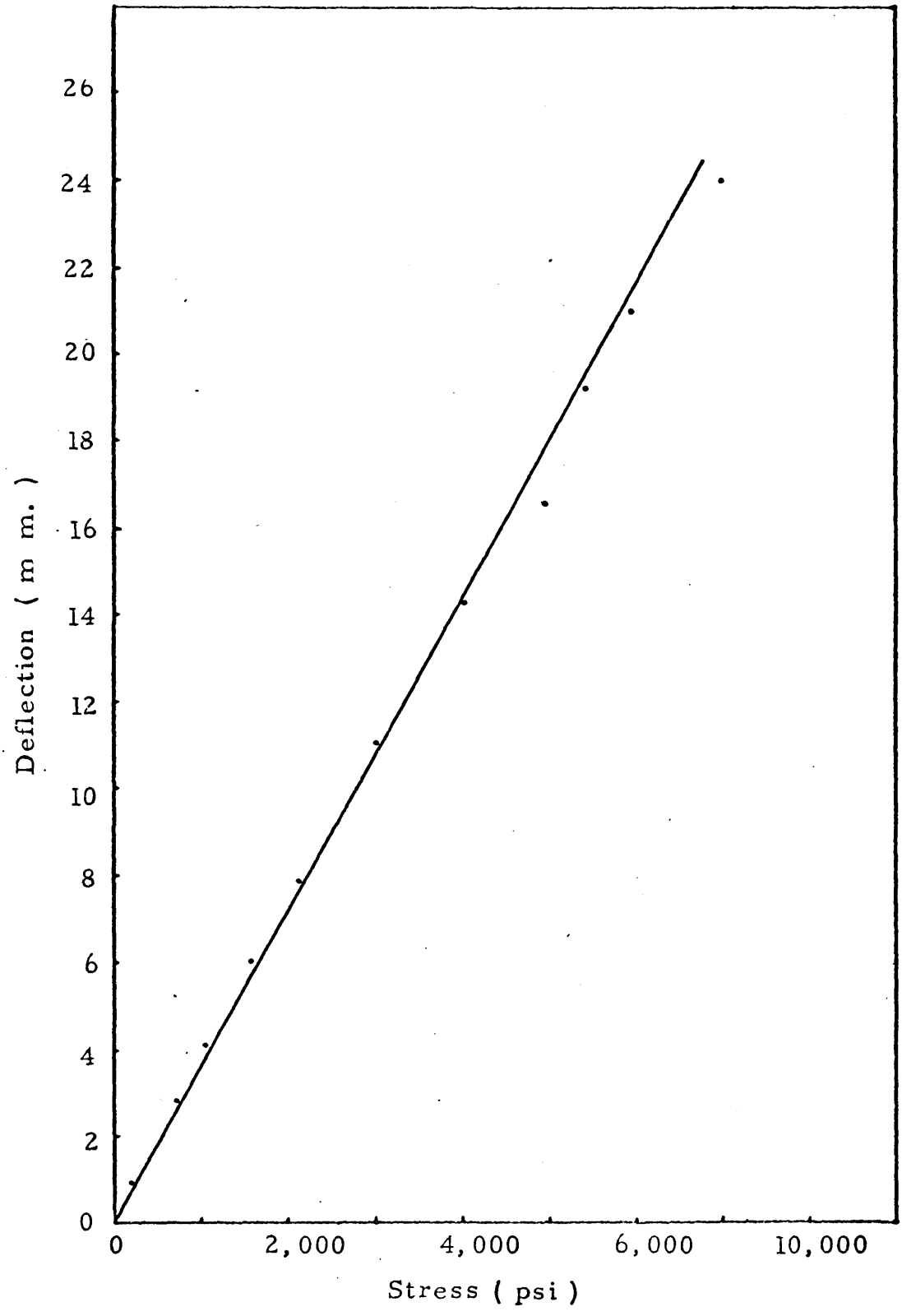

Figure 4. Calibration Curve for the Static Loading Unit.

Dynamic Loading Mechanisms.

Two different types of dynamic loading mechanisms (Figure 5a and 5b) were used to investigate dynamic creep properties of mortar. The sinusoidally varying dynamic stress was imposed to the specimen in each case by means of an eccentric actuated (Figure 6) bearing, which in turn was driven by a 1 inch diameter steel shaft. This shaft was secured to the upper plate by means of four bearing posts, and was connected to a 7-1/2 horsepower induction motor through a pulley system. The motor and its supporting platform could be raised or lowered in order to adjust the tension in belts when various size pulleys were used. The frequency of load application in each case could be varied from 100 to 500 cycles per minute.

The creep testing machine for dynamic loads of type I is shown in Figure 7. It consists of a mild steel base of 1 inch thick, 30 inches wide, and 60 inches long with four bolts 48 inches long and 1-1/4 inch diameter fixed 40 inches center to center on its short dimension. The middle and the top plates both 1 inch thick, 30 inches wide, and 48 inches long were secured in place by means of lock nuts on the four bolts. The dynamic loading unit which consisted of a hammer and a dynamic load spring was housed between the middle and the top plate. Figure 8 shows the load deflection curve of the dynamic load spring. The lower part of the hammer (Figure 9) consisted of two mild steel discs with a ball and socket arrangement for an even distribution of load on the specimen.

The creep testing machine for dynamic loads of type II (Figure 10) consists of the same basic unit as discussed before

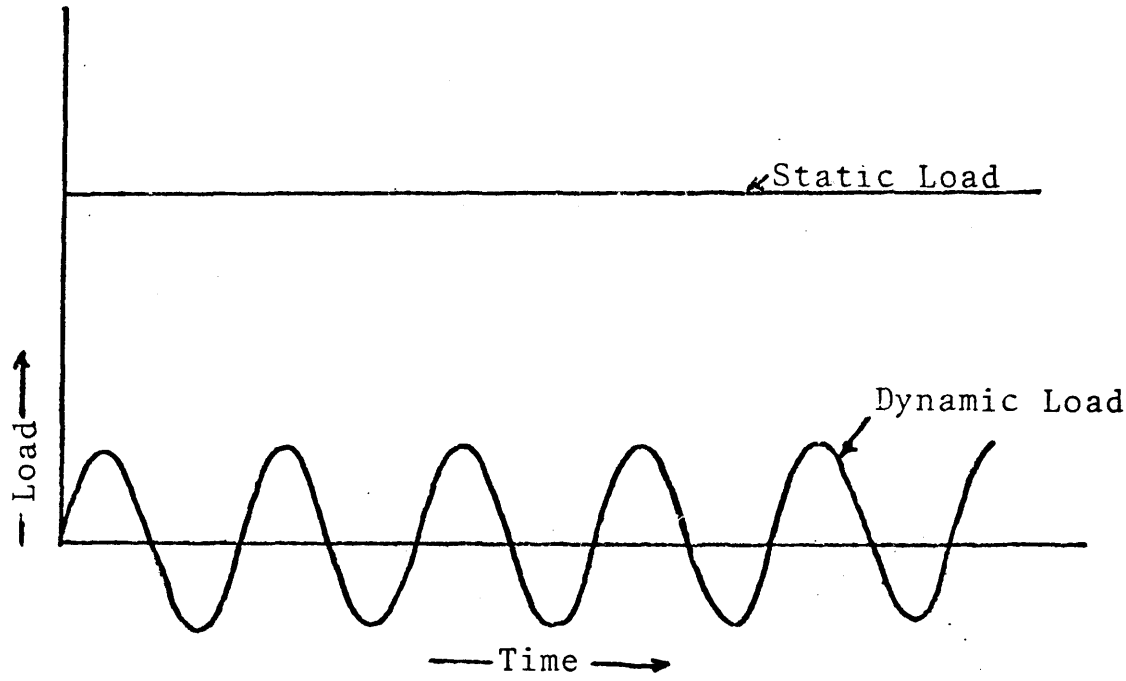

Figure 5a. Diagrammatic Sketch of Dynamic Load Pattern of Type I used in this Investigation.

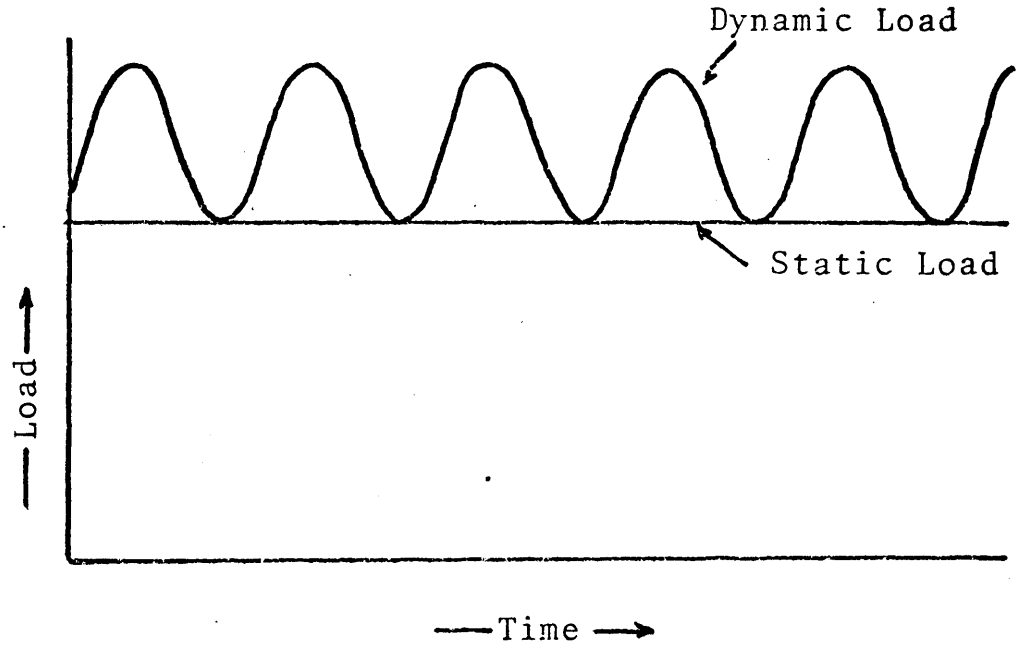

Figure 5b. Dynamic Load Pattern of Type II used in this Investigation.

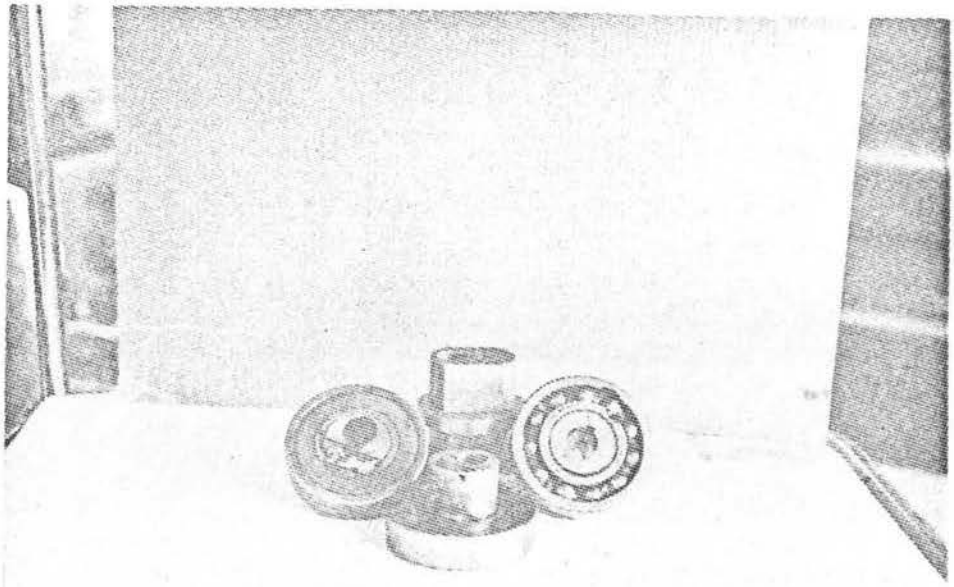

Figure 6. Some of the Eccentrics Housed in Bearings Which Were Used in this Investigation.

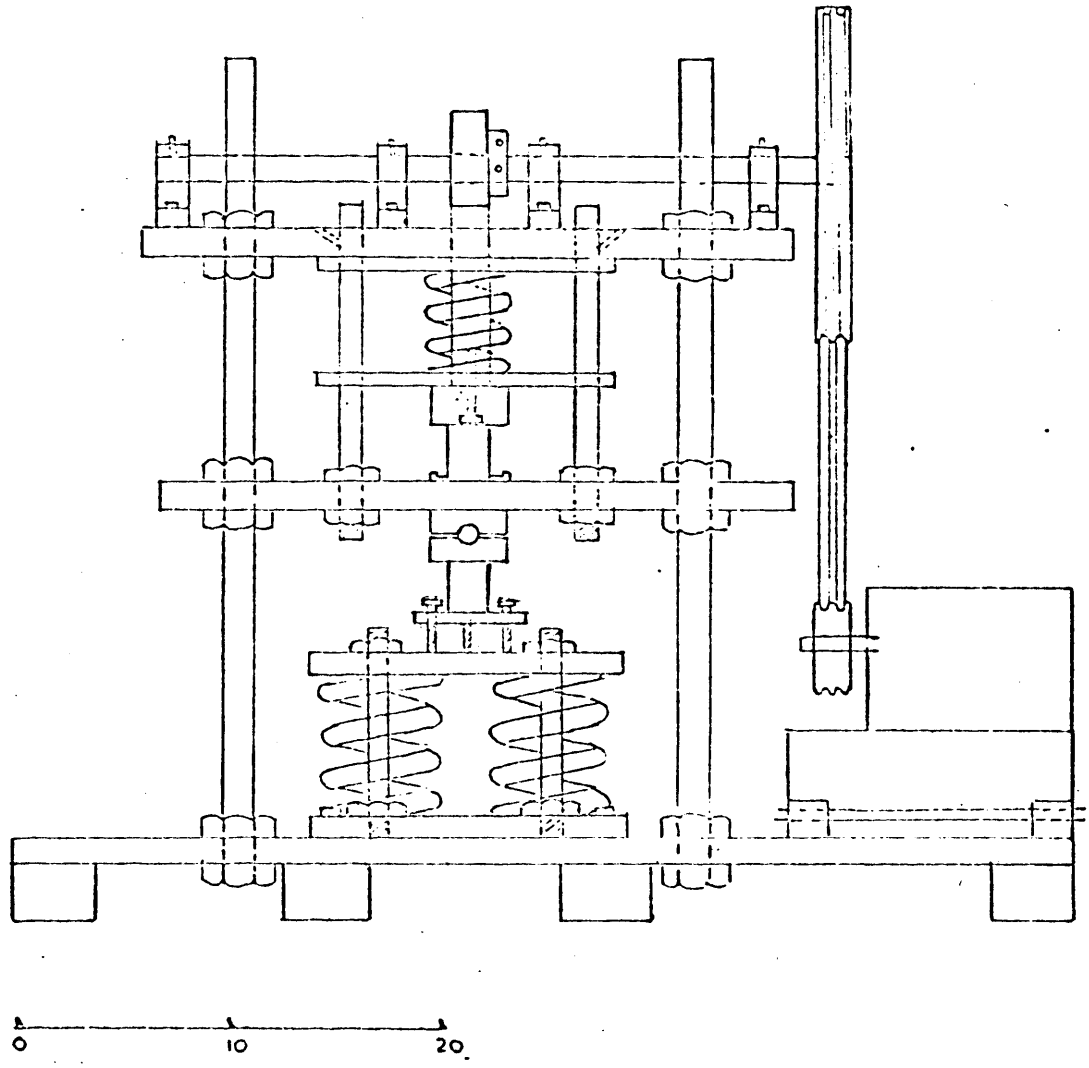

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Figure 7. Dynamic Creep Testing Machine for Dynamic Load of Type I.

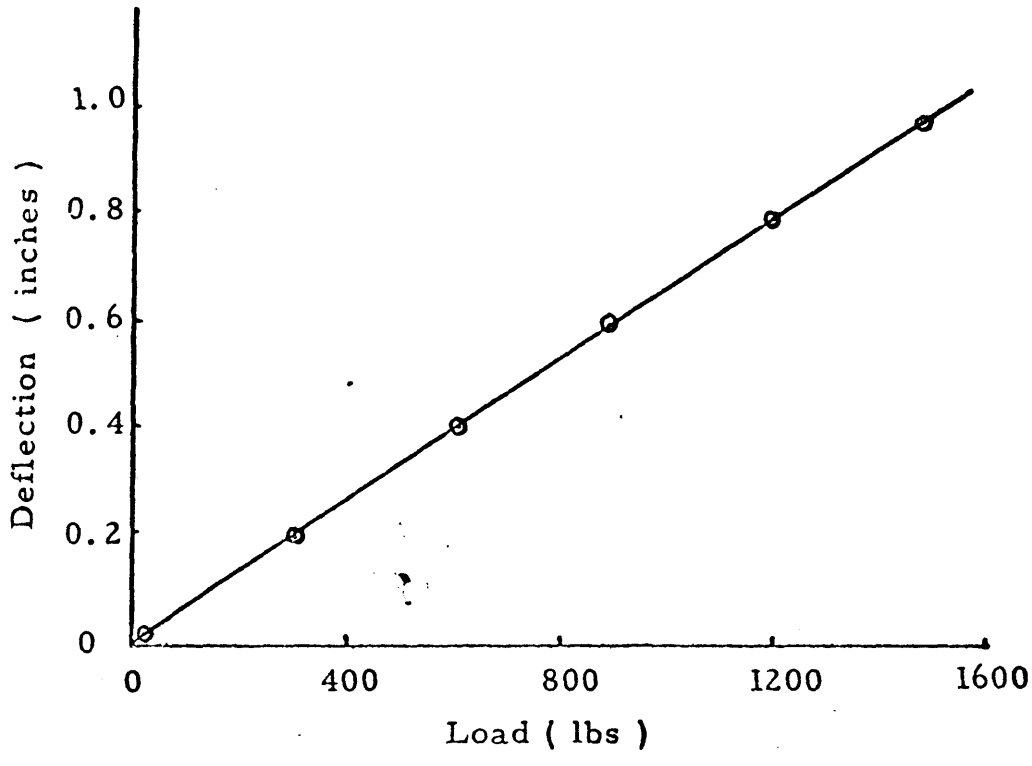


Figure 8. Load Deflection Curve of the Dynamic Load Spring.

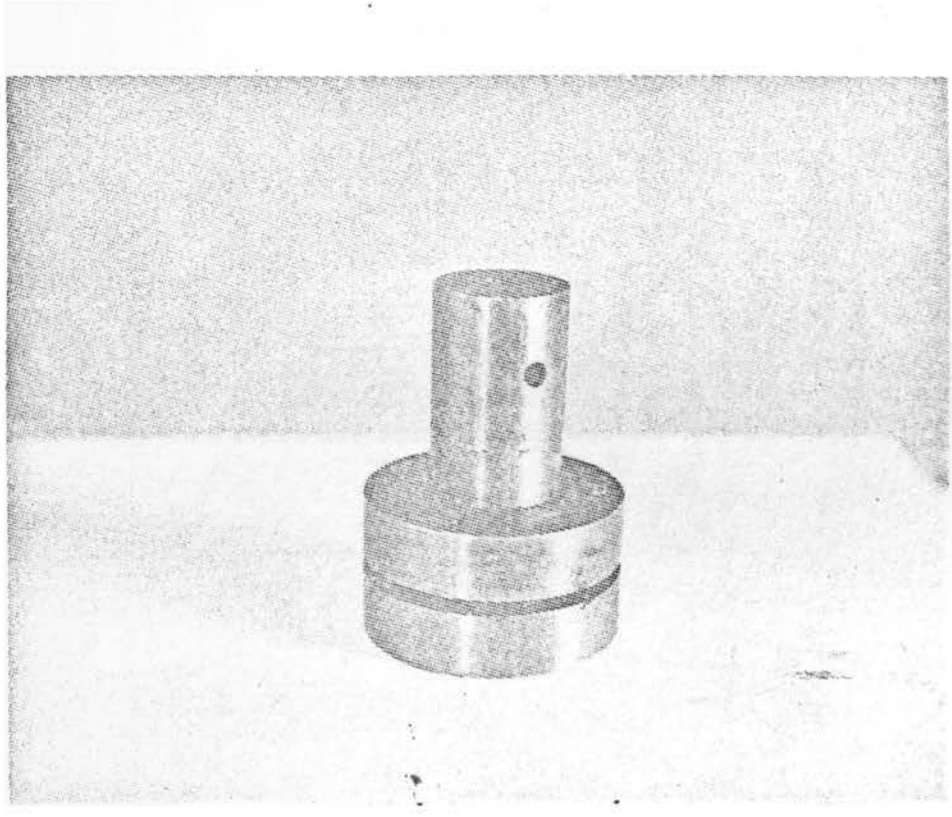
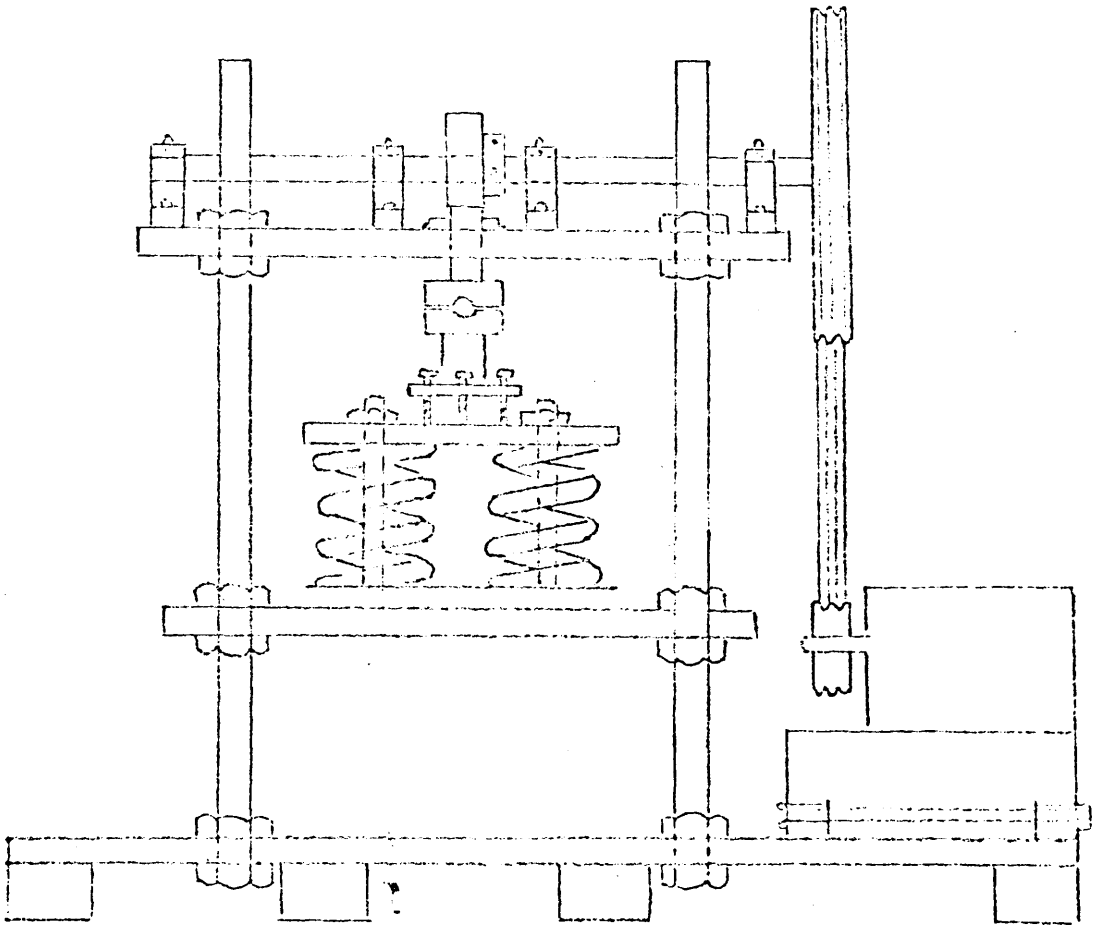


Figure 9. Mild Steel Hammer for Transferring the Dynamic Loads to the Specimens.



0 10 20

Scale: 1 : 10"

Figure 10. Creep Testing Machine for Dynamic Loads of Type II.

with the only difference that in this case that static loading unit was placed on the middle plate of the machine and the specimen rested directly between this unit and the hammer. The top of which was in contact with the eccentric. The dynamic load was achieved by means of an eccentric with an additional compression of the Static Loading unit.

Instrumentation.

The strain gage measuring system (Figure 11) consists of four principal units.

A. A modified Hathaway strain indicator unit to measure static and average dynamic strains at any desired time.

B. A Brush universal type high gain carrier-amplifier model BL-520 for measurement of dynamic strain at any time during test period.

C. A matching Brush single channel direct writing oscillograph model BL-520 for making a continuous record of dynamic and static strain readings.

D. A switching unit for continuous use of the Brush recorder and an intermittent use of the Hathaway strain indicator.

The electrical circuit (Figure 12) contains a Hathaway strain indicator and a Brush recorder together with a temperature compensated Wheatstone bridge circuit. Two active gages were used on the test specimen and two similar gages were fixed on the dummy specimen which compensated for the temperature differences during the test period.

Sample Preparation.

The samples for this investigation were prepared from six-inch cubes of mortar. The mixture contained 4 parts by weight of Portland cement, 2 parts by weight of sand with 0.6 cement-water ratio. This ratio was recommended by the American Society of Testing Materials Standards (2). The

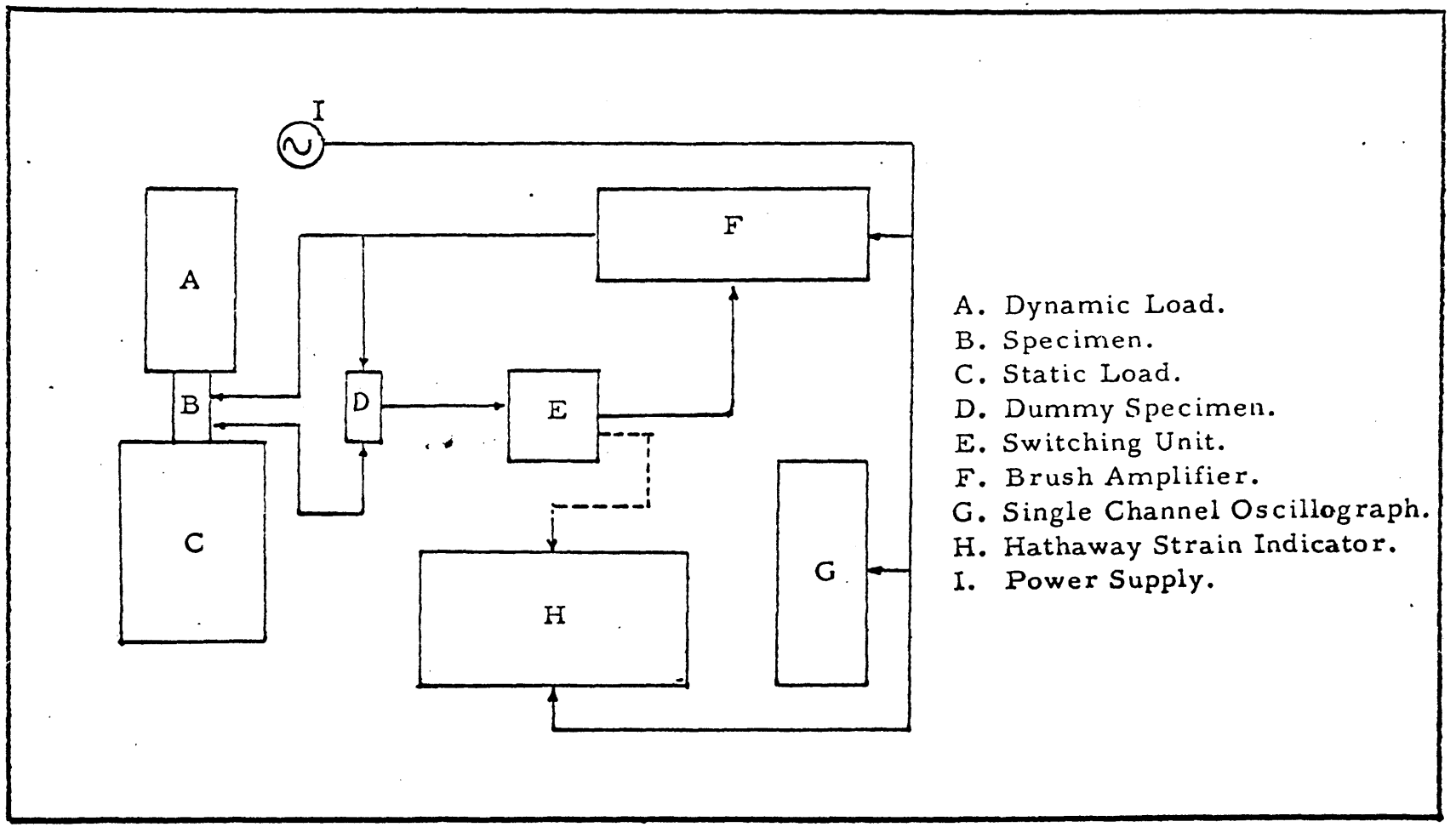


Figure 11. Block Diagram for Strain Measuring System.

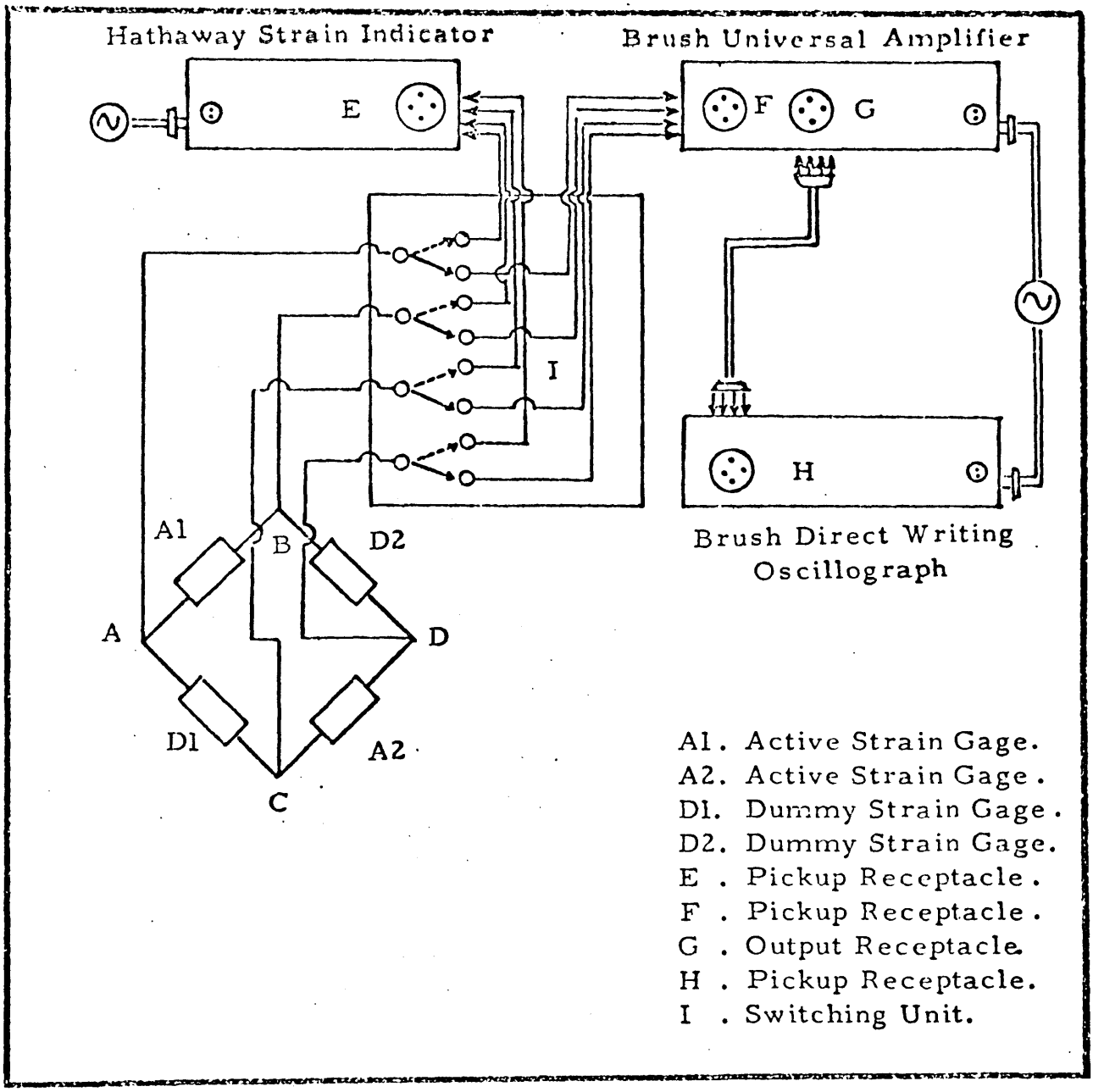


Figure 12. Electrical Circuit Diagram for Strain Measuring Apparatus.

sand selected for this mixture was screened in a Ro-tap sieving machine and only the portion between Tyler series sieves # 40 and # 80 was selected. This combination of sand and cement was mixed thoroughly by hand, and water was gradually added for about two minutes until an even consistency was obtained. The mixture was then poured into a mold of two six-inch cube compartments which had been oiled lightly on the inner sides. After 24 hours the molds were taken to a humidity controlled room where they were kept for eight days at 80 percent humidity.

Six samples were drilled from each block using a core drilling machine with an EX size bit. They were cut to approximately 2.5 inch length by means of a diamond saw and were polished on both ends on a lapidary wheel. The samples were dried for 8 hours in an oven at 100 degrees centrigrade and then air dried for several days before testing. After the surface of the specimen was cleaned with acetone, two strain gages were mounted on opposite sides and parallel to the longitudinal axis of each specimen. Punched foil gages of C9-141 type manufactured by Budd Instruments were initially employed with a special epoxy provided by the manufacturer. However, they were found to be unsatisfactory. They were replaced by SR-4 type A5-1 120 ohms resistance gages which were used with Eastman Kodak 910 cement in accordance with the instructions given by the manufacturer for installation. After the gages were mounted the specimen was allowed to cure for a minimum period of seven days before use.

Representative samples from each block were tested for shrinkage and zero drift, unconfined compressive strength and Young's modulus.

Shrinkage and Zero Drift Test.

Shrinkage and zero drift of the specimens and gages were taken into account for correcting observed strain values. A standard Wheatstone bridge circuit was used which contained two active and two dummy gages. Both normal and reversed strain readings were taken on the two active gages, and curves (Figure 13) for normal, reversed, and median strain were plotted against time for the shrinkage and zero drift test. The average reading of the median strain for the entire period was used for correcting strains observed on the Hathaway and the Brush recorders.

Unconfined Compressive Strength Tests.

One specimen from each batch was subjected to an unconfined compressive strength test in the Tinius-Olsen machine. Table I gives the batch number, air drying time, curing time, and the compressive strength of each sample.

Young's Modulus Test.

Stress vs. strain (Figure 14) was determined for a typical mortar specimen, which was subjected to a loading rate of 20 psi per second and was stressed to about 50 percent of its total compressive strength for the first cycle. The load was then released and the specimen was again stressed to its ultimate strength. The strain readings were observed on the Hathaway strain indicator by using a modified

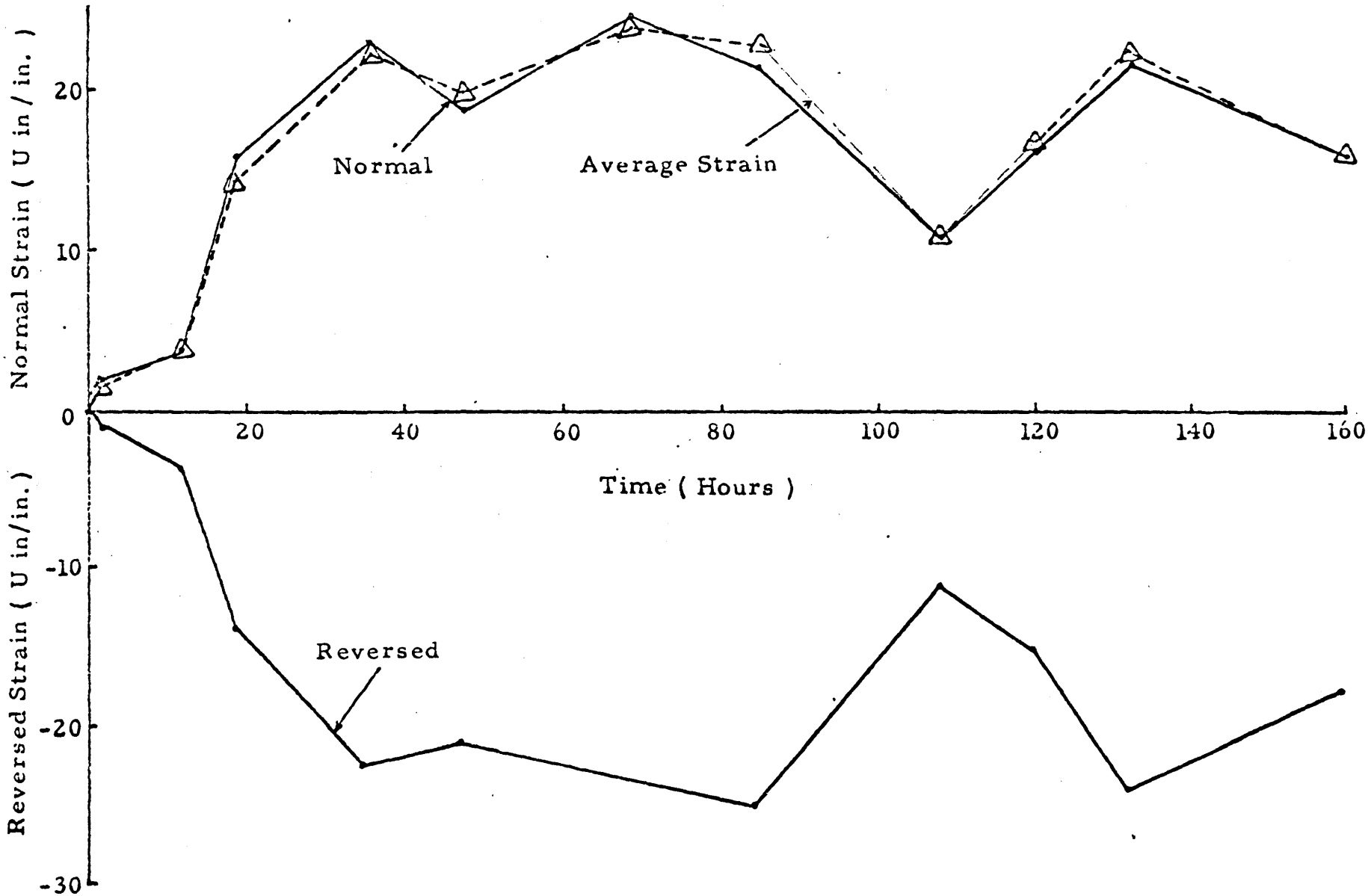


Figure 13. The variation of Strain due to Shrinkage of the Specimen and Zero Drift of S-R 4 gages.

TABLE I

THE BATCH NUMBER , AIR DRYING TIME , CURING TIME AND THE COMPRESSIVE STRENGTH OF THE MORTAR SPECIMENS PREPARED FOR THIS INVESTIGATION.

Batch Number	Air Drying Time	Curing Time	Compr: Strength.
1	24 hours	8 days	7010 psi.
2	24	8	7291
3	21	9	7322
4	24	8	7364
5	20	8	6980
6	24	8	7484
7	24	8	7173

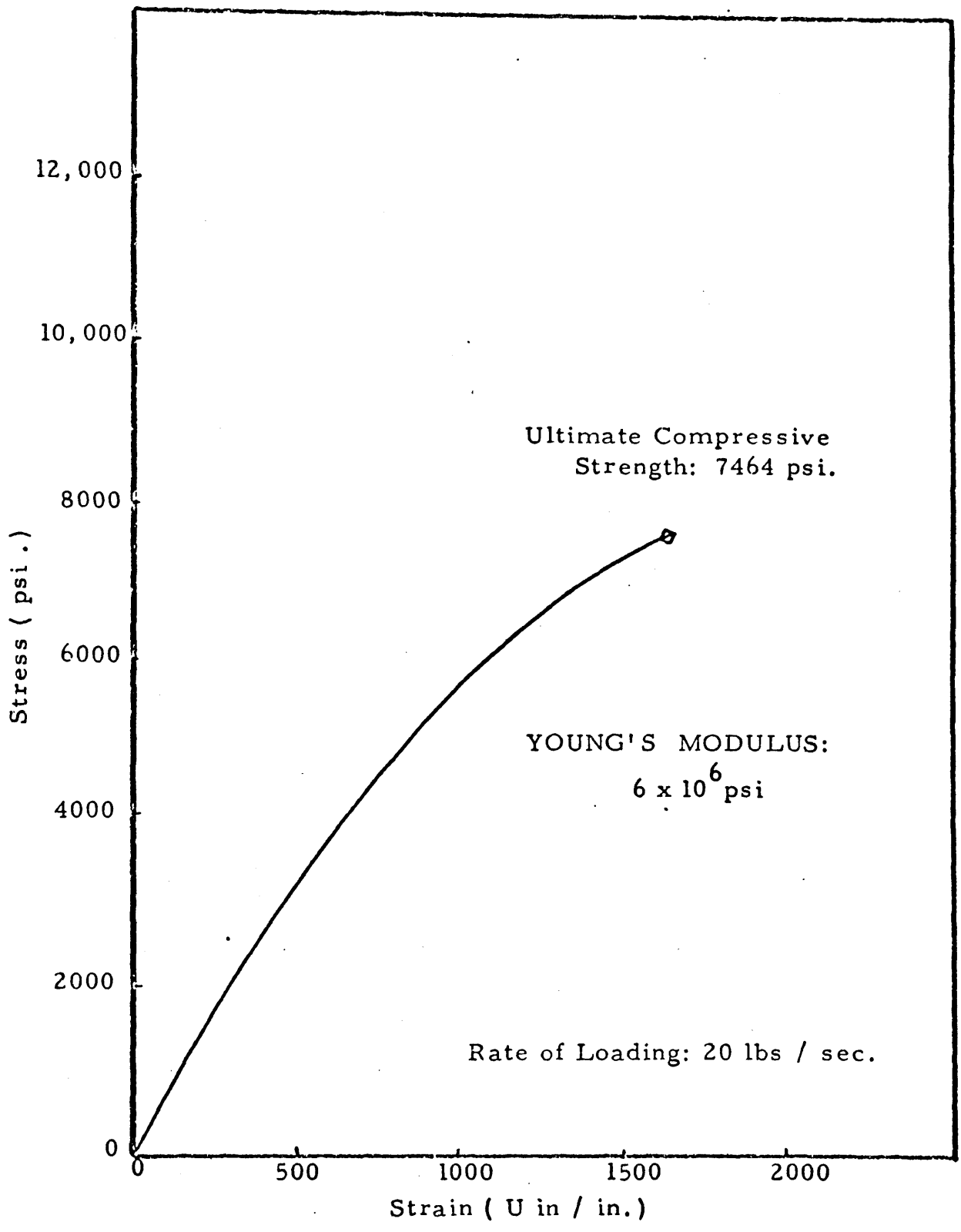


Figure 14. Stress - Strain Plot of Mortar.

Wheatstone bridge circuit with one active and one dummy specimen. Two SR-4 type A-5, 120 ohms resistance gages were used on each of the specimens for measuring strain.

Residual Strain.

For residual strain vs. time (Figure 15) the specimen w was not stressed to its ultimate compressive strength but the load was released at 75 percent of the total compressive strength. After the load had been completely removed, the decrease in residual strain with time was noted.

Static and Dynamic Loading Procedure.

For dynamic loading of type I, the static loading unit with springs compressed to desired stress level was fastened to the base plate of the creep testing machine. The specimen was placed between the hammer and the fine adjustment plate which rested on the static loading unit (Figure 7). The static load on the specimen could be obtained by release of compression on the springs, where as the dynamic load could be achieved by a separate spring resting between the top and the middle plate of the creep testing machine.

In order to obtain dynamic load of type II, the static loading unit was placed on the middle plate of the creep testing machine (Figure 10) and the specimen rested between this unit (with springs compressed to desired stress) and the hammer. The top of which touched the accentric. The instrumentation circuit and testing procedure were identical with type I tests. The Hathaway strain indicator and the Brush recorder were calibrated for zero load level and the oscillograph was run at a faster chart paper speed and dynamic load

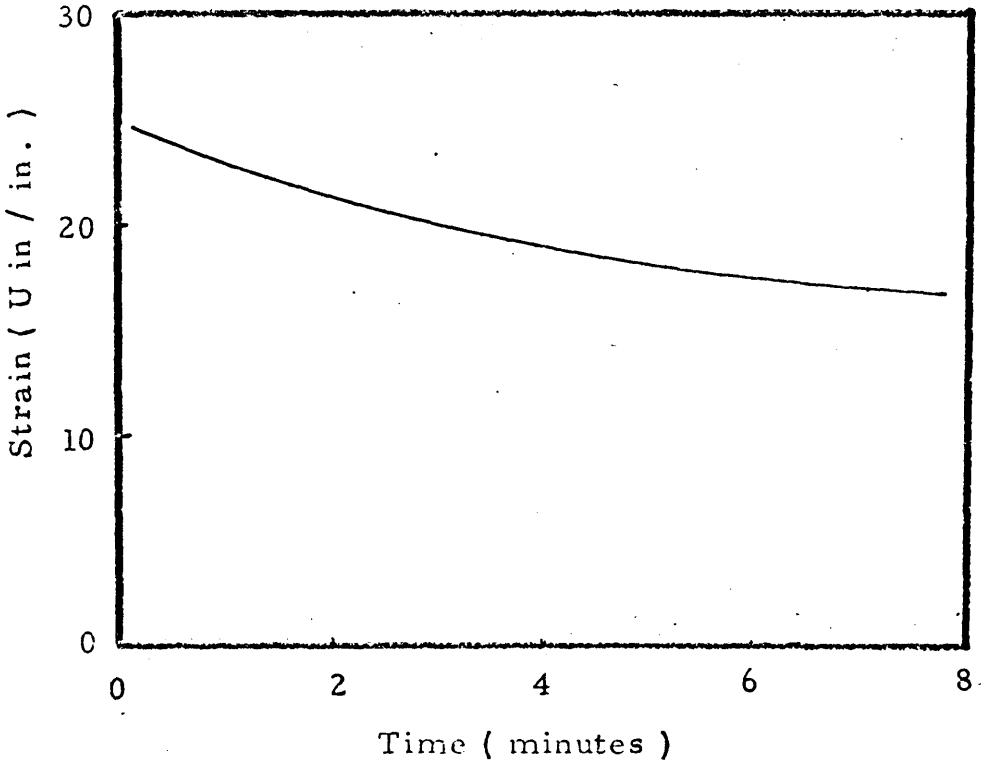


Figure I5. Residual Strain-Time Plot of the Mortar.

was applied with minimum delay. An intermittent record of dynamic strain was made on the chart paper followed by a check with the Hathaway strain indicator for the entire length of the experiment.

CHAPTER IV

MATHEMATICAL CONSIDERATIONS

To account for the inelastic behavior of materials and to obtain qualitative information on their internal structure several types of mechanical models have been developed. The principal use of models is to demonstrate the response of each unit individually and the combined response by superposition of the individual responses.

According to Freudenthal (7) "The theory of mechanical model considers combinations of elements which are supposed to behave mechanically like the constituent phases of the material but, which apart from mechanical behavior, have nothing in common with the real material."

One approach to the problem of time-dependent deformation of a particular material under static and dynamic loads would be to consider the total stress at a particular time to be made up of static stress and alternating stress, and to find the equivalent static stress which would give the same strain-time deformation as the combined stress. Once the equivalent static stress is determined, the viscoelastic coefficients of the material in the frequency domain can be determined by using Fourier transforms.

If a known value of equivalent static stress $\sigma(t)$ is applied to a material whose transform $\sigma(j\omega)$ exists, then the total response of the material $\varepsilon(t)$, which is made up of its

transient and steady state responses can be obtained. If one is able to obtain the transform $\varepsilon(j\omega)$ of the recorded response $\varepsilon(t)$ then the ratio of the transform of strain with the transform of stress yields directly the desired modulus in analytical form expressed continuously as a complex function of frequency. The first part of the mathematical analysis below deals with the development of the concept of equivalent static stress and its validity in representing the dynamic creep data. The second part deals with the use of equivalent static stress for determination of viscoelastic coefficients and complex elastic modulus by a combination of analytical and graphical means.

Dynamic Creep and Equivalent Static Stress. (22)

According to the theory of mechanical equation of state (18), the strain rate $d\varepsilon/dt$ of any material at any time t is a function of stress σ, strain ε, and temperature T and is dependent on its past history, that is:

$$\frac{d\varepsilon}{dt} = F(\sigma, \varepsilon, T) \qquad (1)$$

Such an equation is applicable to the case of creep of many kinds of engineering materials under varying stress at constant temperature. The equation can also be used for the case of a cyclic stress of low frequency. At constant temperature the equation can be simplified to:

$$\frac{d\varepsilon}{dt} = F(\sigma, \varepsilon) \qquad (2)$$

The creep strain in a static creep test can be expressed by the following equation:

$$\varepsilon = \varepsilon_o + bt^{\beta} + Ct \qquad (3)$$

where ε_o is the initial strain, β is the time index of transient creep (ordinarily $0<\beta<1$), b is its coefficient and C is the steady state creep rate. β_o, b, C are the functions of stress and β is a function independent of stress and time. The strain rate is obtained by differentiating equation (3)

$$\frac{d\varepsilon}{dt} = \beta bt^{-(1-\beta)} + C \qquad (4)$$

The equation which will be obtained by eliminating t from the right hand sides of the equations (3) and (4) is the mechanical equation of state for this case, corresponding to eq-equation (2). This equation can be reduced to a simpler form in special cases where the creep curve can be expressed by a transient component alone or transient and a steady state component. In case it is assumed that the transient component alone represents the complete strain-time behavior of the material, equation (3) reduces to:

$$\varepsilon = a\sigma^{\alpha_1} t^{\beta} \qquad (4a)$$

putting $b = a\sigma^{\alpha_1}$

where a, α_1 are the constants independent of stress and time.

In the case where both transient and steady state components are necessary to represent the behavior of the material, equation (4a) can be given as:

$$\varepsilon = a\sigma^{\alpha_1}\, t^{\beta} + a_1\sigma^{\alpha_2}\, t \tag{5}$$

where a_1, α_2 are constants independent of stress and time and the time index of steady state creep is unity. Using equations (4) and (4a) the mechanical equation of state becomes:

$$\frac{d\varepsilon}{dt} = \beta a^{1/\beta}\, \sigma^{\alpha_1/\beta}\, \varepsilon^{-(1-\beta)/\beta} \tag{6}$$

Integration of equation (6), assuming the initial condition as $\varepsilon = 0$ for $t = 0$, gives:

$$\varepsilon = a\left[\int_0^t \sigma^{\alpha_1/\beta}\, dt\right]^{\beta} \tag{7}$$

Therefore, if the stress σ is given as a function of time t, the strain ε can be obtained by using equation (7).

Following the conditions for the tests performed,

$$\sigma = \sigma_m + \sigma_a \sin \omega t \tag{8}$$

where σ_m is the mean static stress, σ_a is the alternating stressm and ω is the angular frequency of the alternating stress. By writing $A = \sigma_a/\sigma_m$ (Stress Ratio), the strain can be expressed as:

$$\varepsilon = a\sigma_m^{\alpha_1}\left[\int_0^t (1 + A \sin \omega t)^{\alpha_1/\beta}\, dwt\right]^{\beta}$$

This equation reduces to:

$$\varepsilon = a\sigma_m^{\alpha_1} t^{\beta} I^{\beta}$$

where

$$I = \frac{1}{2\pi} \int_0^{2\pi} (1 + A \sin \omega t)^{\alpha_1/\beta} d(\omega t) \qquad (9)$$

or

$$\varepsilon = a\, \sigma_e^{\alpha_1} t^{\beta} \qquad (10)$$

where $$\sigma_e = \sigma_m I^{\beta/\alpha_1} \qquad (11)$$

Equation (10) has the same form as equation (4a). The dynamic creep under the mean stress σ_m and stress ratio A is completely the same as under equivalent static stress σ_e defined by equation (11).

Equation (4a) reduces to:

$$\log \sigma + \frac{\beta}{\alpha_1} \log t = \frac{1}{\alpha_1} \log \frac{\varepsilon}{a} \qquad (11a)$$

for which the log σ - log t diagram with a definite value of ε becomes a straight line regardless of the ratio A and the frequency of the alternating stress.

The method of determining constants, the stress and time exponents for equation (11a) is shown in Appendix B. Consequently, provided σ_1 and β are known from the design data diagrams of the static creep tests, the dynamic creep curve for any combination of mean and alternating stress is obtained as a static creep curve under the equivalent static stress σ_e calculated from equations (9) and (11).

The numerical calculations for the determination of equivalent static stress in the nondimensional expressions $E''=(\sigma_m/\sigma_e)$ and $V''=(\sigma_a/\sigma_e)$ were carried out on IBM 360 computer. The format for this program is given in Appendix C. Tables D-1 through D-XVIII (Appendix D) give the calculated values of σ_e, E", and V", with A varying from 0.1 to 90.0 and α_1/β varying from 1 to 35. The mean static stress was taken as unity for each case.

Figures 16 and 17 are the theoretical stress range diagrams for dynamic creep in the nondimensional expressions V" and E" with α_1/β as a parameter. Any combination of σ_a and σ_m on a line of Figures 16 and 17 gives the same amount of strain provided σ_e is the same. For straight lines through the origin the stress ratio is constant. Figures 16 and 17 provide a convenient means of determining the equivalent static stress σ_e when data on static creep are available and the nature of dynamic stress is known.

In order to check the validity of the concept of equivalent static stress, numerical calculations were made for the total dynamic strain at various intervals of time with

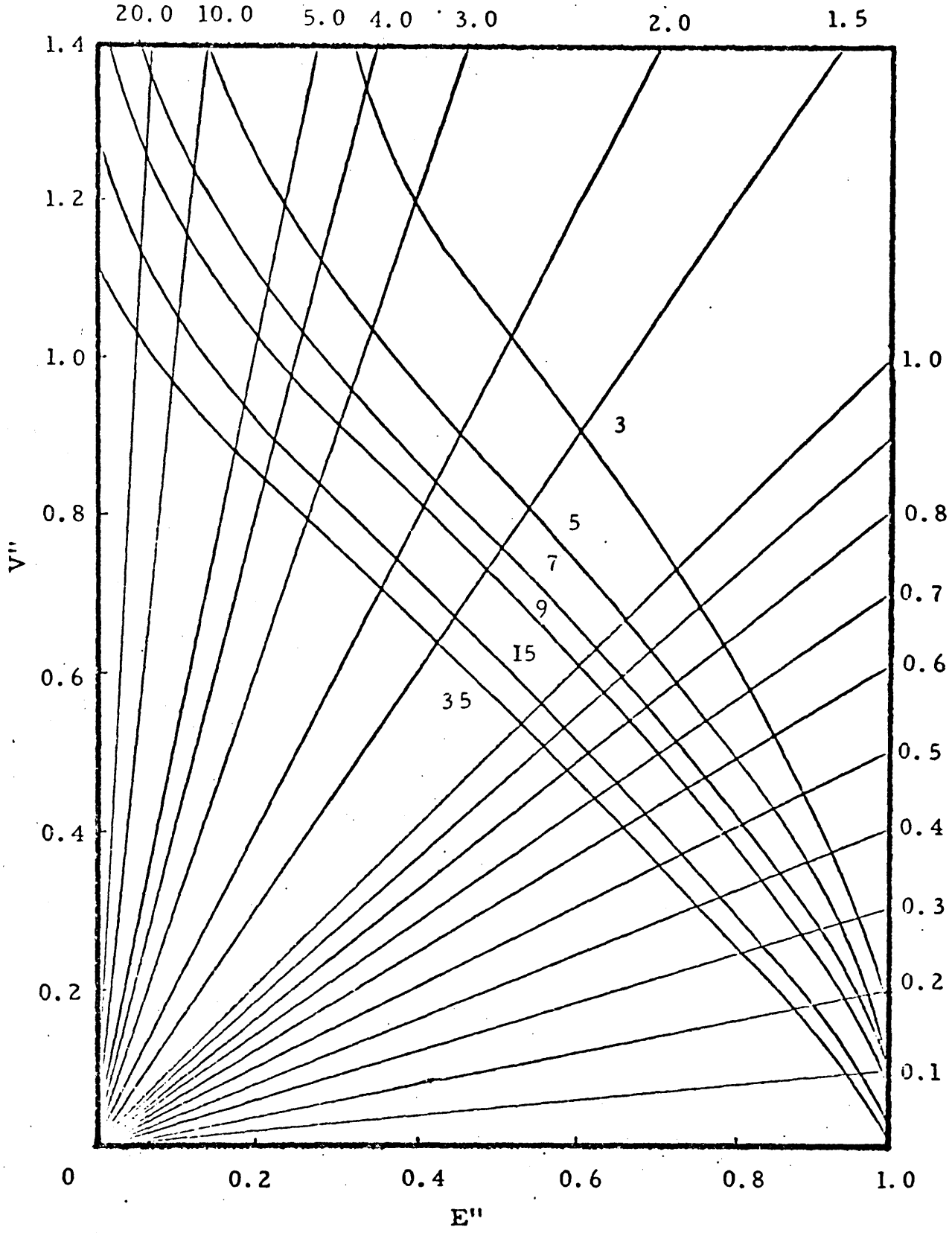


Figure 16. Theoretical Stress Range Diagram for Dynamic Creep in Non-Dimensional Expressions E'' and V'' for odd Values of α_1/β.

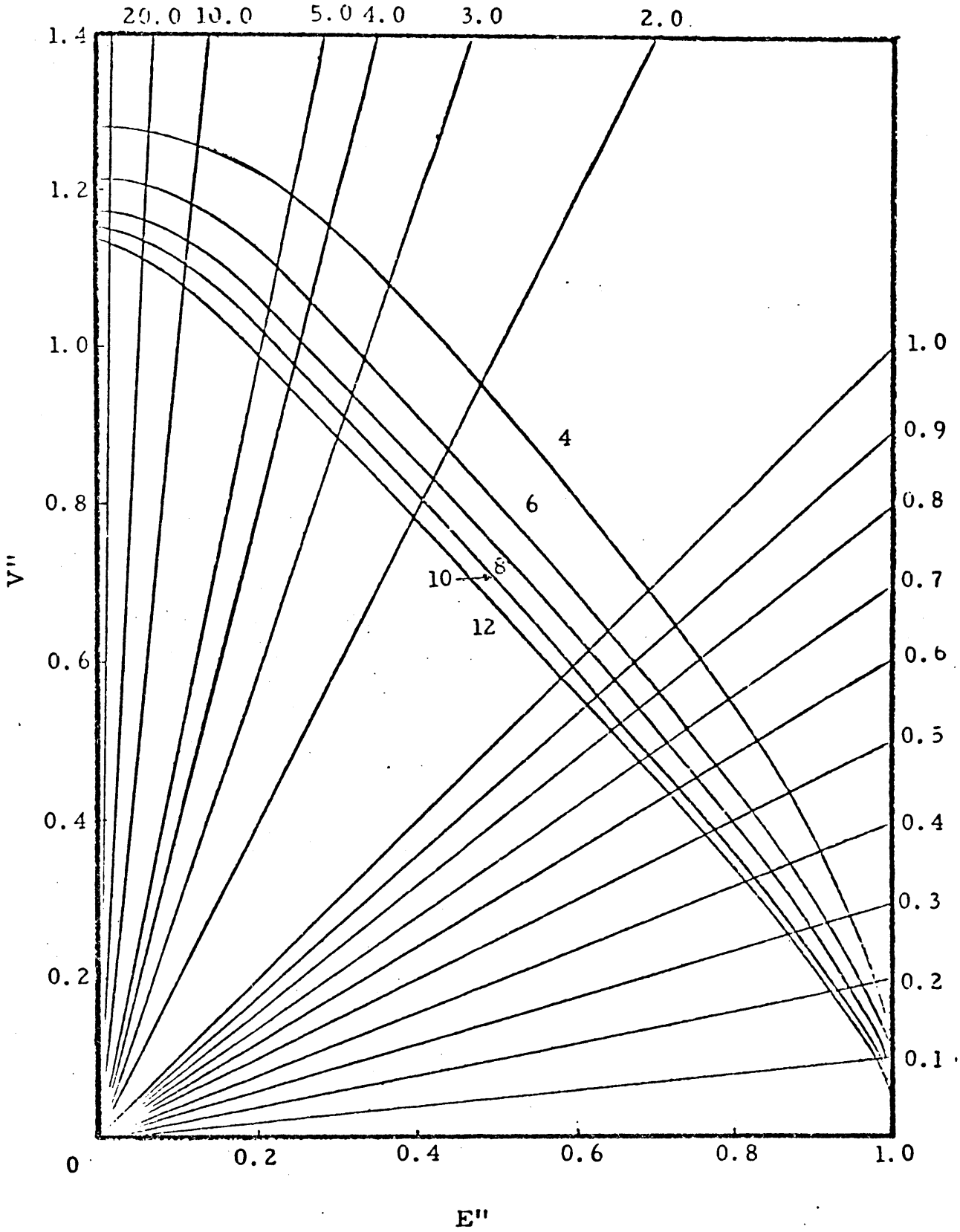


Figure 17. Theoretical Stress Range Diagram for Dynamic Creep in Non-Dimensional Expressions E'' and V'' for even Values α_1/β.

equivalent stress varying from 500 to 5,000 psi for low values of A and 100 to 1,000 psi for higher values of A. The computed values in Tables D-XX to D-XXIX (Appendix D) show the dynamic strain calculated for values of A ranging from 0.1 to 90.0 and for time from 0.1 hour to 80 hours. The stress and the time indices used for calculating the dynamic strain were taken from the transient state of static creep test on mortar. It was assumed that the same indices hold true for the steady state. The zero time values were also calculated and are shown in Table D-XIX (Appendix D). It was considered that at zero time the static load alone was applied to the specimen.

Tables D-XXX to D-XXXIX (Appendix D) show similar calculated results for the case when the transient state was terminated at 10 hours and the exponent of stress determined from the steady state portion of static creep curve of mortar was used for time between 10 and 100 hours. The time index for the steady state portion of the creep curve was taken as unity.

The formats used for the calculation of dynamic strains under transient and steady state conditions are shown in Appendix C. After checking the validity of the concept of equivalent static stress, the second part of the problem was to determine the viscoelastic coefficients of the mechanical model which would best represent the dynamic creep behavior of mortar.

Determination of Complex Elastic Moduli for Mortar. [20]

Mathematically the complex elastic modulus, $\overset{*}{E}$, relates the axial sinusoidal stress applied to the linear viscoelastic

strain. It is a complex number whose magnitude is the ratio of the amplitude of the applied sinusoidal stress to that of the resulting sinusoidal strain, and whose phase is the angle by which the strain lags the stress. The complex elastic modulus is a function of frequency alone, since for a linear material the ratio of the amplitude of the stress to the strain and the phase angle change only with frequency.

Once $\overset{*}{E}$ is established for a given body its response to any type of axial stress can be calculated by means of Fourier or Laplace transforms by using $\overset{*}{E} = \overset{*}{\sigma}/\overset{*}{\varepsilon}$ (20). To obtain the Fourier transform of the response, it is easier and more accurate to take the transform of the strain rate instead of strain. The accuracy comes about as a result of approximating the differential function $\dot{\varepsilon}$ (t) rather than original curve ε (t). In transforming the axial response of mortar from the time domain to the frequency domain, the curve representing the axial strain as a function of time is first differentiated graphically to obtain the curve of the rate of axial strain as a function of time. This curve is then approximated by a series of exponentials. The steps adopted for such an approximation were as follows:

1. The steady state rate of strain $\dot{\varepsilon}_{ss}$ was subtracted throughout from the total rate of strain $\dot{\varepsilon}$ (t).

2. The resulting curve was plotted on semilog paper with the rate of strain on the vertical log scale and the lowest portion of the curve was approximated by a straight line.

3. The difference in the rate of strain between the

curve and the straight line was calculated as a function of time and the result was again plotted on a semilog paper.

4. The lower portion of the curve was again approximated by a straight line and a second difference calculated.

5. The process was repeated until the remaining difference could be completely represented by a straight line.

6. Exponentials representing each of the straight lines were determined and added to the constant rate to obtain an approximation of the original $\dot{\varepsilon}$ (t) curve. The rate of strain as a function of time was expressed in the following form:

$$\dot{\varepsilon}\ (t) = A_1 e^{-k_1 t} + A_2 e^{-k_2 t} + A_3 e^{-k_3 t} + A_n e^{-k_n t} + \dot{\varepsilon}_{ss} \quad (12)$$

where $A_n e^{-k_n t}$ is the equation of the straight line and $\dot{\varepsilon}_{ss}$ is the constant rate of strain. To obtain the Fourier transform of the curve represented by the approximated rate of strain, the following transformation was used:

$$F\left[\dot{\varepsilon}\ (t)\right] = \overset{*}{\varepsilon}\ (j\omega) = \int_0^\infty \dot{\varepsilon}\ (t)\ e^{-j\omega t}\ dt \quad (13)$$

It was assumed that the strain and hence the rate of strain was zero for $t < 0$. Integrating equation (13) by parts:

$$\overset{*}{\varepsilon}\ (j\omega) = \left[\varepsilon(t)\ e^{-j\omega t}\right]_0^\infty + j\omega \int_0^\infty \varepsilon(t)\ e^{-j\omega t}\ dt \quad (14)$$

Equation (14), as it stands, does not converge at its upper limit unless $\varepsilon(t) \neq 0$, which is not the case here. In order

to overcome this difficulty, the related function

$\dot{\varepsilon}(t)\, e^{at}$ with "a" as a positive constant was transformed to give:

$$F\left[\dot{\varepsilon}(t)e^{-at}\right] = \int_0^\infty \dot{\varepsilon}(t)e^{(-a+j\omega)t}\, dt + \dot{\varepsilon}^*\,(a+j\omega) \qquad (15)$$

Integrating it by parts:

$$\dot{\varepsilon}^*(a+j\omega) = \left[\varepsilon(t)e^{-(a+j\omega)t}\right]_0^\infty + (a+j\omega)\int_0^\infty \varepsilon(t)\, e^{-(a+j\omega)t}dt \qquad (16)$$

Now this expression will converge to zero at its upper limit for any positive value of "a", no matter how small, provided $\varepsilon(t)$ does not grow large as rapidly as an exponential function such as t becomes infinite. Defining $\dot{\varepsilon}^*(j\omega)$ as the limit of the transform $\dot{\varepsilon}^*\,(a + j\omega)$ when "a" approaches zero:

$$\dot{\varepsilon}^*(j\omega) = -\,\varepsilon(o) + j\omega\,\dot{\varepsilon}^*(j\omega) \qquad (17)$$

where $\varepsilon(o)$ is the instantaneous strain.

Using equation (13), equation (12) is transformed to:

$$\dot{\varepsilon}^*(j\omega) = A_1\int_0^\infty e^{-kt}e^{-j\omega t}dt + A_2\int_0^\infty e^{-kt}e^{-j\omega t}dt + \ldots\dot{\varepsilon}_{ss}\int_0^\infty e^{-j\omega t}dt \qquad (18)$$

Equation (18) can be represented in the following form:

$$\dot{\varepsilon}^*(j\omega) = \frac{A_1}{k_1+j\omega} + \frac{A_2}{k_2+j\omega} + \ldots + \frac{A_n}{k_n+j\omega} + \frac{\dot{\varepsilon}_{ss}}{j\omega} \qquad (19)$$

Using equation (17) for the transform of strain equation (19) becomes:

$$\dot{\varepsilon}^*(j\omega) = \left[\frac{1}{(j\omega)}\quad \frac{A_1}{k_1+j\omega} + \frac{A_2}{k_2+j\omega} + \ldots + \frac{A_n}{k_n+j\omega} + \frac{\dot{\varepsilon}_{ss}}{j\omega} + \varepsilon(o)\right] \qquad (20)$$

If $\sigma(t) = \sigma_o$ for $t > 0$

and $\sigma(t) = 0$ for $t < 0$

Using fundamentals:

$$\overset{*}{\sigma}(j\omega) = \frac{\sigma_e}{j\omega} \quad \text{and} \quad \overset{*}{E}(j\omega) = \frac{\overset{*}{\sigma}(j\omega)}{\overset{*}{\varepsilon}(j\omega)}$$

where $\overset{*}{\sigma}(j\omega)$ is Fourier transform of the time function $\sigma(t)$ we get:

$$\overset{*}{E}(j\omega) = \frac{\sigma_e}{\frac{A_1}{k_1+j\omega} + \frac{A_2}{k_2+j\omega} + \ldots + \frac{An}{k_n+j\omega} + \frac{\dot{\varepsilon}ss}{j\omega} + \varepsilon(0)} \qquad (21)$$

or

$$\overset{*}{E}(j\omega) = \frac{1}{\frac{1}{\frac{k_1\sigma_e}{A_1}+\frac{j\omega\sigma_e}{A_1}} + \frac{1}{\frac{k_2\sigma_e}{A_2}+\frac{j\omega\sigma_e}{A_2}} + \ldots + \frac{1}{\frac{k_n\sigma_e}{A_n}+\frac{j\omega\sigma_e}{A_n}} + \frac{1}{\frac{j\omega\sigma_e}{\dot{\varepsilon}_{ss}}} + \frac{1}{\frac{\sigma_e}{\varepsilon(0)}}} \qquad (22)$$

Equation (22) is the fundamental relation sought. This equation represents the transformed response of the material from the time domain to the frequency domain. Using electrical analog concept (Appendix E), equation (22) is transformed to:

$$\overset{*}{E}(j\omega) = \frac{1}{\frac{1}{E_1+j\omega\lambda_1} + \frac{1}{E_2+j\omega\lambda_2} + \ldots + \frac{1}{E_n+j\omega\lambda_n} + \frac{1}{j\omega\lambda_o} + \frac{1}{E_o}} \qquad (23)$$

A comparison of equations (22) and (23) shows that they are identical in form. Therefore, the mechanical behavior of mortar can be approximated by a mechanical model of the type shown in Figure 18. The magnitudes of different parameters E_i and λ_i can be obtained by inspection of equations (22)

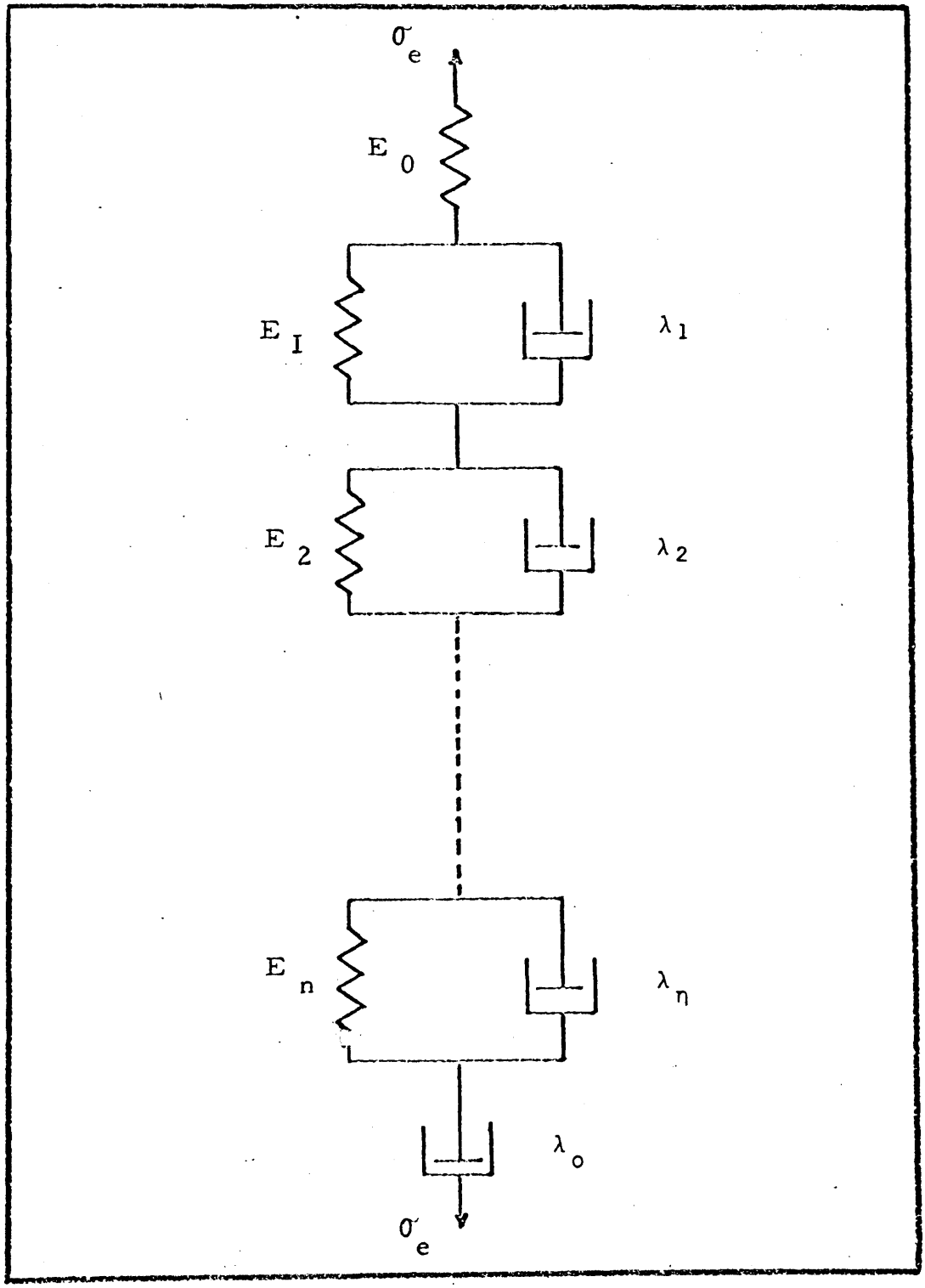


Figure 18. Mechanical Model Representing the Behavior of Mortar.

and (23). The various viscoelastic coefficients of such a model can be determined by the following relationships:

$$E_i = K_i \sigma_e / A_i$$

$$\lambda_i = \sigma_e / A_i$$

$$E_o = \sigma_e / \varepsilon(0)$$

$$\lambda_o = \sigma_e / \dot{\varepsilon}_{ss}$$

where i = 1 to n.

CHAPTER V

INTERPRETATION AND CORRELATION OF RESULTS

In making the correlation between the theoretical and experimental results for the dynamic creep behavior of mortar the following points were kept in mind:

1. Since mortar is a somewhat heterogeneous material it is difficult to obtain the same results for two similar specimens of the same block under identical conditions of loading. This effect is apparent in Table I which shows the total compressive strength of several samples from different batches.

2. The dynamic strain at zero time cannot be calculated mathematically since the whole equation becomes zero at that time, therefore, the value of strain obtained experimentally under static loading conditions was used in the dynamic strain-time plots.

3. After the application of static load on the specimen the dynamic load was superimposed as early as possible. A small delay in the application of this load caused lower strain values than those predicted by the mathematical equation which assumes that the dynamic and static stresses are applied at the same instant.

4. During the course of experiment, a slight relaxation of the spring occured due to the deformation in the specimen. This caused a decrease in the effective stress and hence a lower value of the resulting dynamic strain.

5. The readings obtained on the Hathaway strain indicator represented the average dynamic strain over a cycle, since there was a little time delay between the readings taken on the Brush recorder and on the Hathaway strain indicator, a small difference in the dynamic strain values was observed.

Figure 19 is based on the transient state data. It shows a straight line relationship between log dynamic strain and log equivalent static stress for the time from 0.1 to 80 hours. Since this relationship is valid for all stress ratios A, subsequently, if the equivalent static stress is known, it is possible to predict the dynamic strain for any positive value of time. Similarly Figure 20 represents the relationship between log dynamic strain and log equivalent static stress for the steady state condition, which extends from 10 to 70 hours.

Figures D-1 to D-9 (Appendix D) represent the dynamic creep of mortar over a period of 70 hours for different static stress levels and varying values of the stress ratio A. These figures are based on the theoretical results obtained from both the transient and steady state data of the static creep curves.

To determine the effect of frequency of dynamic excitation and superimposed dynamic loads, a series of tests was run in which the specimens were loaded with identical static and dynamic stress levels. For low magnitude dynamic excitations (Dynamic Load of Type I) frequencies of 150,225 and 250 rpm were used whereas for superimposed dynamic loads (Type II)

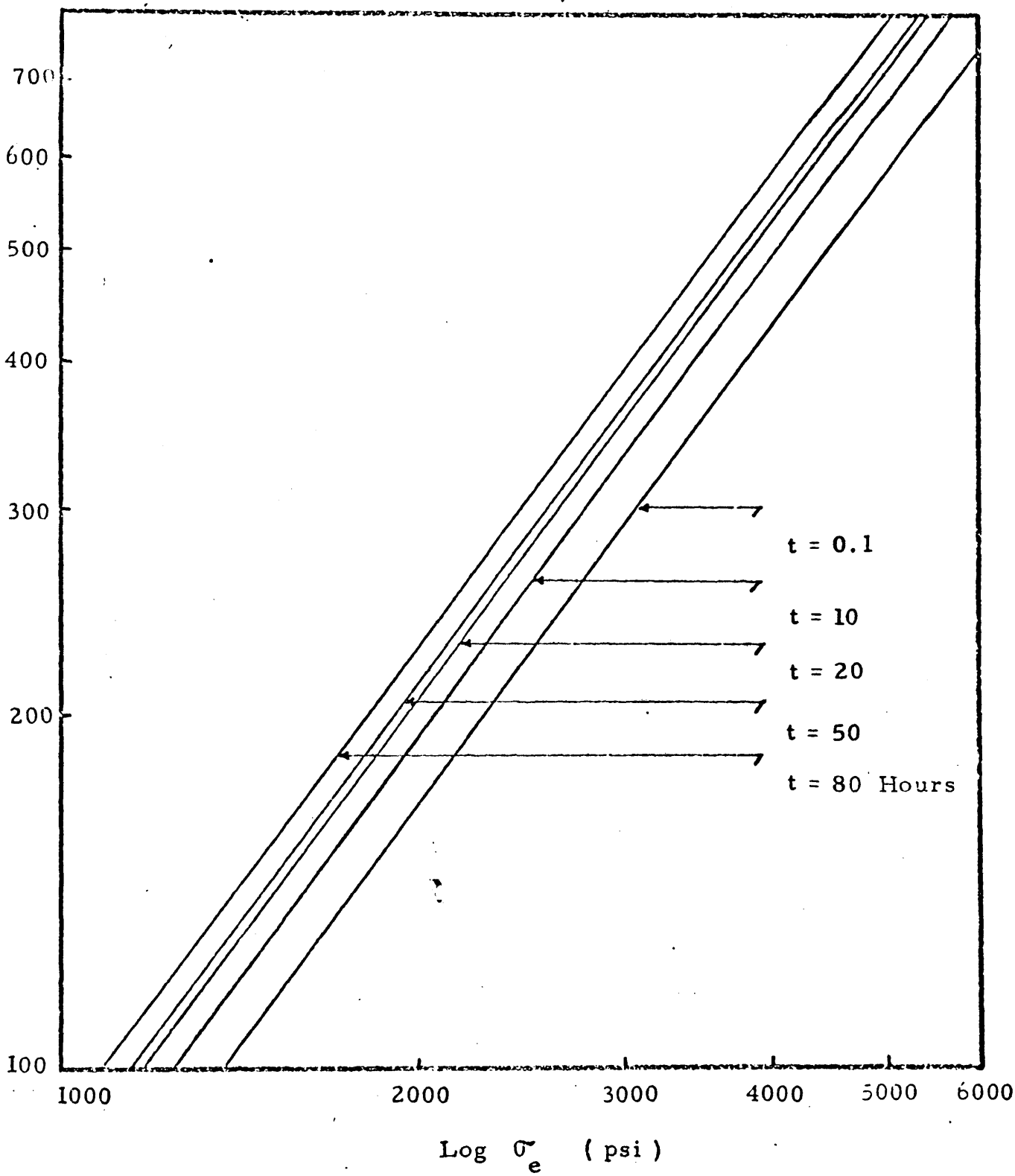


Figure 19. Relationship between Log Dynamic Strain and Log Equivalent Static Stress for Transient Solution

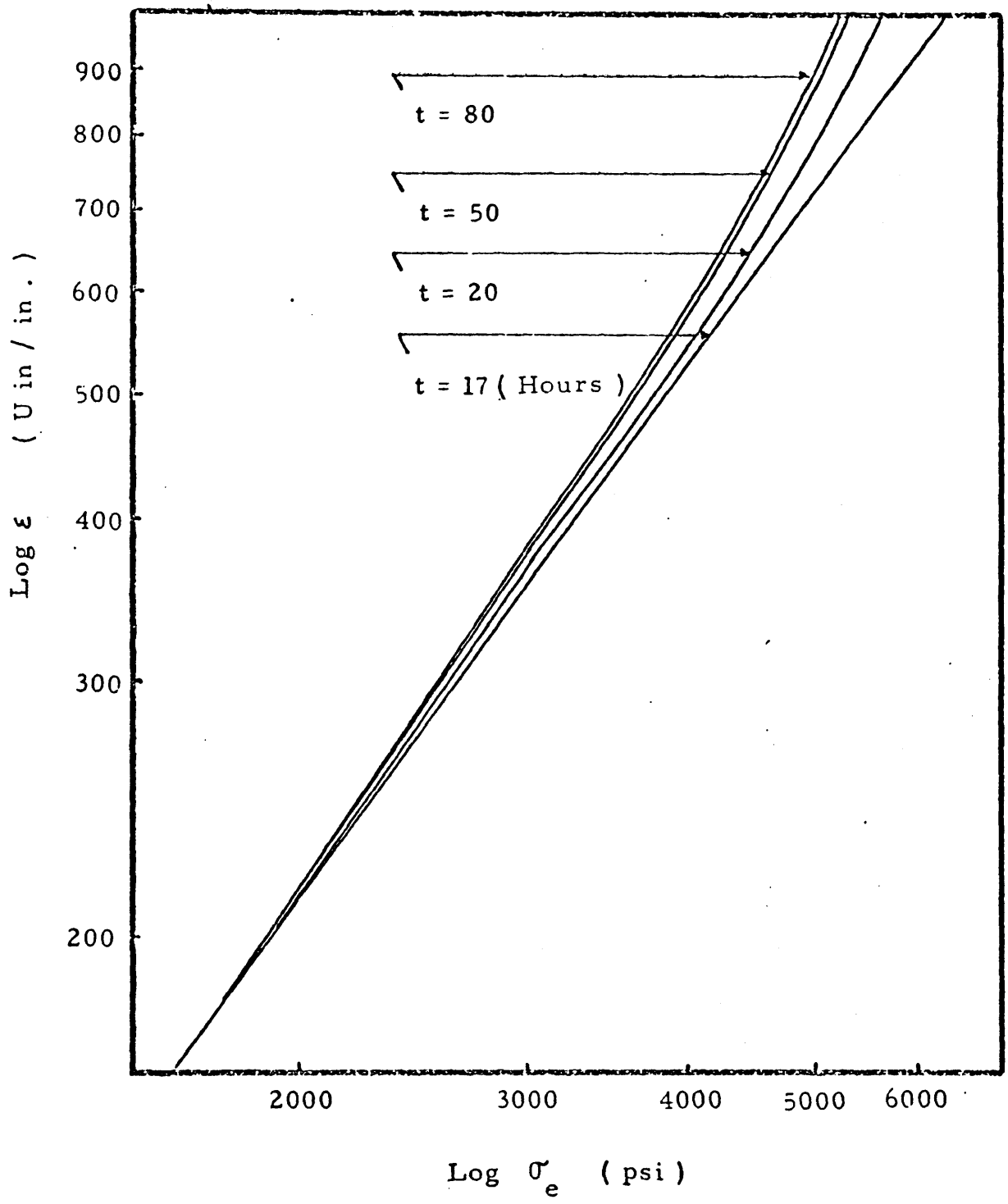


Figure 20. Relationship between Log Dynamic Strain and Log Equivalent Static Stress for Steady State Solution

frequencies of 150 and 225 rpm were used. Tables II and III show the experimental results obtained for each frequency. The results indicate that for the lower frequency the dynamic strain was more dependent on the level of static and dynamic load rather than the frequency. However a shift from a low to an intermediate or high frequency caused considerable difference in dynamic strain.

The results in Tables II and III also indicate that for smaller frequency the dynamic strain was lower than for the higher frequency. The total difference, however, did not amount to more than 3 to 4 percent in the first case and 5 to 18 percent in the second type of applied dynamic loads.

Tables IV and V show the theoretical results obtained under dynamic excitations of low magnitude. It was observed that in all cases where low levels of static stress were applied an agreement between the theoretical and experimental results could be obtained only if both transient and steady state solutions predicted by the mathematical analysis were used. The experimental results in all cases were found to be slightly lower than the theoretical results.

Tables VI and VII show a similar comparison between theoretical and experimental results for superimposed dynamic loads. It was observed that in this case the mathematical analysis based on the transient state data of static creep compared very favorably for all stress ratios and all levels of static stress.

Table VIII presents the results of two experiments in which the sum of static and alternating stress (Type II) was kept the

TABLE F1

EFFECT OF FREQUENCY ON THE DYNAMIC CREEP FOR THE SAME EQUIVALENT STATIC STRESS

DYNAMIC LOAD (TYPE I)

I = 150 rpm
II = 225 rpm
III = 270 rpm

σ_s = 3,285 psi σ_a = 978 psi σ_e = 3,993 psi A = 0.3

DYNAMIC STRAIN (μ in./in)

TIME (HOURS)	THEORETICAL	EXPERIMENTAL		
		150	225	270
0.1	432	420	429	431
0.5	463	453	456	462
1.0	476	472	464	468
2.0	490	480	489	483
5.0	510	492	498	499
10.0	524	511	523	523
17.0	---	512	529	529
20.0	540	529	532	536
30.0	550	530	538	544
40.0	556	533	537	---
50.0	561	---	---	---
60.0	565	---	---	---
70.0	569	---	---	---
80.0	572	---	---	---

TABLE III

EFFECT OF FREQUENCY ON DYNAMIC CREEP

FOR SUPERIMPOSED DYNAMIC LOAD

OF TYPE II

I. 150 rpm

II. 225 rpm

σ_s = 2,000 psi σ_a = 1,200 psi σ_e = 2,995 psi A = 0.6

DYNAMIC STRAIN (μ in./in.)

TIME (Hours)	THEORETICAL	EXPERIMENTAL	
		225 rpm	150 rpm
0.1	292	281	237
0.5	313	284	246
1.0	323	299	249
2.0	332	317	260
5.0	344	326	272
10.0	355	342	281
17.0	---	351	290
20.0	365	359	294
30.0	372	---	---
40.0	376	---	---
50.0	379	---	---

TABLE IV

THEORETICAL AND EXPERIMENTAL COMPARISON OF DYNAMIC CREEP

FOR DIFFERENT STATIC AND ALTERNATING STRESSES WITH CONSTANT

STRESS RATIO A= 0.3

I.	σ_s = 1,086 psi	σ_a = 326 psi	σ_e = 97 psi
II.	σ_s = 2,172	σ_a = 652	σ_e = 250
III.	σ_s = 3,258	σ_a = 978	σ_e = 433

DYNAMIC STRAIN (μ in./in.)

TIME (Hours)	TRANSIENT STATE			STEADY STATE			EXPERIMENTAL		
	I	II	III	I	II	III	I	II	III
0.1	97	250	433	---	---	---	115	238	405
0.5	104	267	463	---	---	---	117	260	410
1.0	107	275	476	---	---	---	118	272	430
2.0	110	283	490	---	---	---	118	275	442
5.0	115	294	509	---	---	---	119	290	465
10.0	118	302	524	---	---	---	120	291	480
17.0	---	---	---	118	303	530	119	305	493
20.0	121	311	540	118	304	532	120	306	497
30.0	123	317	549	119	305	540	121	308	500
40.0	125	320	556	119	306	547	121	---	502
50.0	126	323	561	119	307	555	122	---	506
60.0	127	326	565	120	309	563	---	---	510
70.0	128	328	569	120	310	570	---	---	512
80.0	129	330	572	120	311	518	---	---	---

TABLE V

THEORETICAL AND EXPERIMENTAL COMPARISON OF DYNAMIC CREEP

FOR DIFFERENT STATIC AND ALTERNATING STRESSES WITH CONSTANT

STRESS RATIO A = 0.5

I. σ_s = 650 psi σ_a = 325 psi σ_e = 914 psi

II. σ_s = 1,575 σ_a = 787 σ_e = 2,215

III. σ_s = 2,500 σ_a = 1,250 σ_e = 3,516

DYNAMIC STRAIN (μ in./in.)

TIME (Hours)	TRANSIENT STATE			STEADY STATE			EXPERIMENTAL		
	I	II	III	I	II	III	I	II	III
0.1	58	194	364	--	---	---	57	190	370
0.5	62	208	389	--	---	---	58	197	380
1.0	64	214	400	--	---	---	59	205	390
2.0	66	220	412	--	---	---	60	215	405
5.0	68	229	429	--	---	---	62	224	425
10.0	70	235	441	--	---	---	63	230	439
17.0	--	---	---	71	236	444	64	235	448
20.0	72	242	454	71	236	445	65	240	452
30.0	75	247	467	71	237	449	65	248	457
40.0	76	250	472	71	237	454	65	252	462
50.0	76	252	472	71	238	458	--	257	---
60.0	77	254	475	71	238	462	--	---	---
70.0	77	256	479	71	239	467	--	---	---
80.0	77	257	481	71	240	472	--	---	---

TABLE VI

THEORETICAL AND EXPERIMENTAL CORRELATION OF RESULTS FOR SUPERIMPOSED DYNAMIC LOADS WITH VARIOUS STRESS RATIOS A

I.	σ_s = 415 psi	σ_a = 830 psi	σ_e = 1,160 psi	A = 2.0
II.	σ_s = 1,500	σ_a = 1,200	σ_e = 2,522	A = 0.8
III.	σ_s = 2,000	σ_a = 1,200	σ_e 2,995	A = 0.6

DYNAMIC STRAIN (μ in./in.)

TIME (Hours)	TRANSIENT STATE			STEADY STATE			EXPERIMENTAL		
	I	II	III	I	II	III	I	II	III
0.1	81	232	292	--	---	---	101	241	281
0.5	86	248	313	--	---	---	105	249	284
1.0	89	255	323	--	---	---	109	254	299
2.0	91	262	332	--	---	---	111	268	317
5.0	95	273	344	--	---	---	115	279	326
10.0	97	281	355	--	---	---	119	291	342
17.0	--	---	---	98	281	356	122	---	351
20.0	100	289	365	98	282	357	122	297	359
30.0	102	294	372	98	283	359	127	---	---
40.0	104	298	376	98	284	361	---	---	---
50.0	105	301	379	98	285	364	---	---	---

TABLE VII

THEORETICAL AND EXPERIMENTAL CORRELATION OF RESULTS FOR SUPERIMPOSED DYNAMIC LOADS (EFFECT OF DYNAMIC STRESS)

I. σ_s = 1,500 psi σ_a = 1,200 psi σ_e = 2,522 psi A = 0.8

II. σ_s = 1,500 σ_a = 2,000 σ_e = 3,256 A = 1.33

DYNAMIC STRAIN (μ in./in.)

TIME (Hours)	TRANSIENT STATE		STEADY STATE		EXPERIMENTAL	
	I	II	I	II	I	II
0.1	232	328	---	---	241	349
0.5	248	350	---	---	249	368
1.0	255	361	---	---	254	372
2.0	262	371	---	---	268	389
5.0	273	386	---	---	279	399
10.0	281	397	---	---	291	412
17.0	---	---	281	399	---	418
20.0	289	409	282	400	297	429
30.0	294	416	283	403	---	454
40.0	298	421	284	406	---	---
50.0	301	425	285	409	---	---

TABLE VIII

THEORETICAL AND EXPERIMENTAL DYNAMIC CREEP COMPARISON

FOR THE SAME COMBINED STATIC AND DYNAMIC STRESS

AND DIFFERENT EQUIVALENT STRESS

I. σ_s = 1,500 psi σ_a = 1,200 psi $\sigma_s+\sigma_a$ = 2,700 psi σ_e = 2,522 psi A = 0.8

II. σ_s = 700 σ_a = 2,000 $\sigma_s+\sigma_a$ = 2,700 σ_e = 2,510 A = 2.85

DYNAMIC STRAIN (μ in./in.)

TIME (Hours)	TRANSIENT STATE		STEADY STATE		EXPERIMENTAL	
	I	II	I	II	I	II
0.1	232	230	---	---	241	228
0.5	248	246	---	---	249	242
1.0	255	253	---	---	254	259
2.0	262	261	---	---	268	265
5.0	273	271	---	---	279	272
10.0	281	279	---	---	291	283
17.0	---	---	281	279	---	294
20.0	289	287	282	280	297	314
30.0	294	292	283	281	---	328
40.0	298	295	284	282	---	---
50.0	301	298	285	283	---	---

same but the stress ratio A was different. It was observed that even though the peak stress in both the cases was the same the theoretical and experimental results were different. The results of the experimental investigation confirmed the validity of the concept of equivalent static stress to represent the dynamic behavior of mortar for any stress ratio over a period of time extending up to 50 hours. The experimental results further indicate that in order to have a good agreement with the theoretical results for superimposed dynamic loading conditions, a mathematical solution based on the transient state data of static creep is sufficient.

The concept of equivalent static stress was also used to predict the mathematical model that would best fit the experimental results. Since the stress in the time domain is related to strain by means of differential operators, which are difficult to handle, it is easier to represent them in the frequency domain in which the relationships are algebraic and hence easier to manipulate. The complex modulus is thus expressed from a single static test covering a wide range of time. The dual dynamic and static stress is replaced with an equivalent static stress which is then used to determine the complex modulus of the material. This approach gives an analytic expression for the modulus as a continuous function of frequency. Once the complex modulus has been obtained in the analytical form it is possible to use the concept of an electrical analog to replace it by a mechanical model, all the

parameters of which can be easily found. The model representation of the time-dependent behavior of mortar under an equivalent static stress of 3,993 psi is presented in Appendix F.

CHAPTER VII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The objectives of this investigation were:

1. To determine the dynamic creep behavior of mortar specimens under cyclic loads of low frequency.

2. To obtain a mathematical solution which would fit the experimental results.

3. To present a mechanical model which would approximate the dynamic creep behavior of mortar under simultaneous static and dynamic loads.

Summary.

The experimental results indicate that the behavior of mortar under dynamic excitation of low magnitude and superimposed dynamic loads do not vary considerably with change of frequency from one low level to another. Within the range of frequencies used, a maximum change of 3 to 4 percent for the former and 5 to 18 percent for the later type of dynamic loads was observed.

The study indicated that for all stress ratios, A, the dynamic creep of mortar can be expressed in terms of equivalent static stress, which represents the behavior for low magnitude dynamic excitations as well as for superimposed dynamic loads. Furthermore, it was observed that the dynamic response under dual loads is not equal to the simple sum of the stresses but is a function of the stress ratio A and the static stress level. The dynamic behavior is expressed as a relationship between equivalent static stress,

dynamic strain and time. The experimental results indicate that the creep behavior of mortar under superimposed dynamic loads approximates the mathematical equivalent solution obtained from the transient state of static creep data.

To determine the complex elastic modulus of mortar at any frequency level the equivalent static stress was used to find an analytical expression for the modulus as a continuous function of frequency. Once the complex modulus is obtained in an analytical form it may be replaced by a mechanical model of known parameters by means of an electrical analog. It was found that mortar, at levels of static and dynamic stress sufficiently low compared to its ultimate compressive strength approximated a linear viscoelastic body whose strain-time relationships could be predicted by the concepts stated above.

Conclusions.

The conclusions derived from this investigation are:

1. With all other conditions of loading being the same, a nominal increase in frequency caused 3 to 5 percent increase in creep in dynamic strain for low magnitude dynamic excitations and an increase of 5 to 18 percent for superimposed dynamic loads.

2. The time dependent behavior of mortar under dynamic stress of Type I can be approximated by a combined mathematical transient and steady state solutions.

3. For superimposed loads (Type II) the mathematical solution based on the transient state data of static creep compares favorably for the entire length of the experiment. The steady state portion of the mathematical solution gives lower results than those obtained experimentally.

4. The dynamic creep behavior of mortar is effectively represented by the concept of equivalent static stress provided the dynamic and static stress levels are kept considerably lower than the total compressive strength of the material.

5. The total effective stress giving the dynamic strain values is not a simple sum of the static and dynamic stress but is a function of the static stress and the stress ratio A.

6. The equivalent static stress may be used successfully to determine the frequency governed complex modulus of mortar, which in turn can be represented by a mechanical model by means of an electrical analog.

Recommendations.

Areas of further investigation which many be taken on the subject are:

1. An investigation of the dynamic creep behavior of mortar under an intermediate and high frequency range for an exact determination of the role of frequency.

2. A design of a hydraulic system for the application of static load on the specimen in which the precise load level could be maintained.

3. A suitable design of a system by which static and dynamic loads could be applied and recorded instantaneously on a fast moving chart paper.

4. An application of various forms of dynamic loads and their relationship with the time-dependent dynamic creep.

5. Investigation of the dynamic creep characteristics of geologic materials, particularly low and high strength rocks.

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APPENDIX A

VISCOELASTIC MODELS

One of the useful methods of representing the behavior of a viscoelastic material on a phenomenological level is by means of mechanical models. A model may consist of various combinations of Hookian springs and Newtonian dashpots in which each unit represents a particular type of material response. The two basic combinations of elastic and viscous elements are the Maxwell and Kelvin or Voigt unit. Figures A-1 and A-4 show the arrangement of each of these models.

Maxwell Unit.

A Maxwell unit is composed of a spring and a dashpot connected in series. The stress in the two elements of this unit is the same, whereas the strains and the rates of strains are additive. Denoting σ as constant stress and ε as strain the mathematical equation can be written as:

$$\dot{\varepsilon} = \frac{\dot{\sigma}}{E_m} = \frac{\sigma}{\eta_m} \qquad \text{(A-1)}$$

where E_m and η_m are the coefficients of the elastic and viscous elements respectively, and $\dot{\varepsilon}$ represents the strain rate with respect to time. The integration of equation (A-1) yields:

$$\varepsilon = \frac{\sigma}{E_m} + \int \frac{\sigma}{\eta_m}\, dt \qquad \text{(A-2)}$$

Under a suddenly applied constant stress σ_o equation (A-2) reduces to:

$$\varepsilon = \frac{\sigma_o}{E_m} + \frac{\sigma_o}{\eta_m} t + \varepsilon_o \qquad \text{(A-3)}$$

Figure A-2 shows the response of this function for $\sigma_o = 0$. When a constant value of strain ε_ρ is applied then $\dot{\varepsilon}_\rho = 0$ and equation (A-1) becomes:

$$0 = \frac{\dot{\sigma}}{E_m} + \frac{\sigma}{\eta_m} \qquad \text{(A-4)}$$

Solving this equation for σ we get:

$$\sigma = Ae^{-t/\tau_m} \qquad \text{(A-5)}$$

for $t = 0$, $\varepsilon = \varepsilon_\rho$ and $\sigma = E\varepsilon_\rho$

Therefore $A = E\varepsilon_\rho$ or $\sigma = \varepsilon_\rho e^{-t/\tau_m}$ (A-6)

where: $\tau_m = \eta_m / E_m$

Equation (A-6) indicates that under a constant deformation the stress relaxes exponentially and reaches 1/e of its value in τ_m units of time (Figure A-3). The parameter τ_m is called the "Relaxation Time" of the unit.

Kelvin or Voigt Unit.

A Kelvin unit is composed of a spring and a dashpot in parallel. In this case the strains and the rates of strains are the same for both the elements, whereas, the stresses are additive. The mathematical equation for such a model is:

$$\sigma = E_k\varepsilon + \eta_k\dot{\varepsilon} \qquad \text{(A-7)}$$

If a constant stress σ_o is applied, equation (A-7) becomes:

$$\sigma_o = E_k\varepsilon + \eta_k\dot{\varepsilon} \qquad \text{for } 0<t<t_1$$

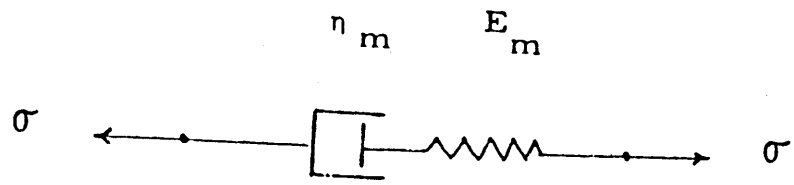

Figure A-1. The Maxwell Unit.

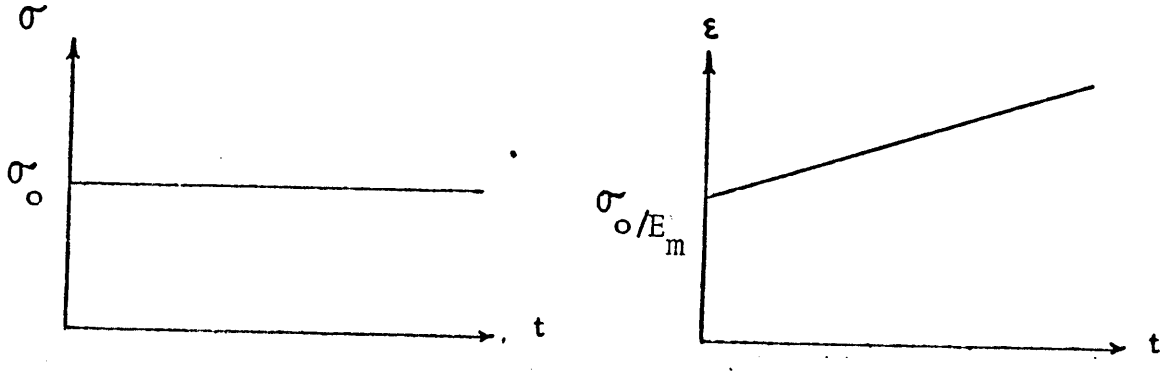

Figure A-2. The Response of Maxwell Unit to a Constant Stress.

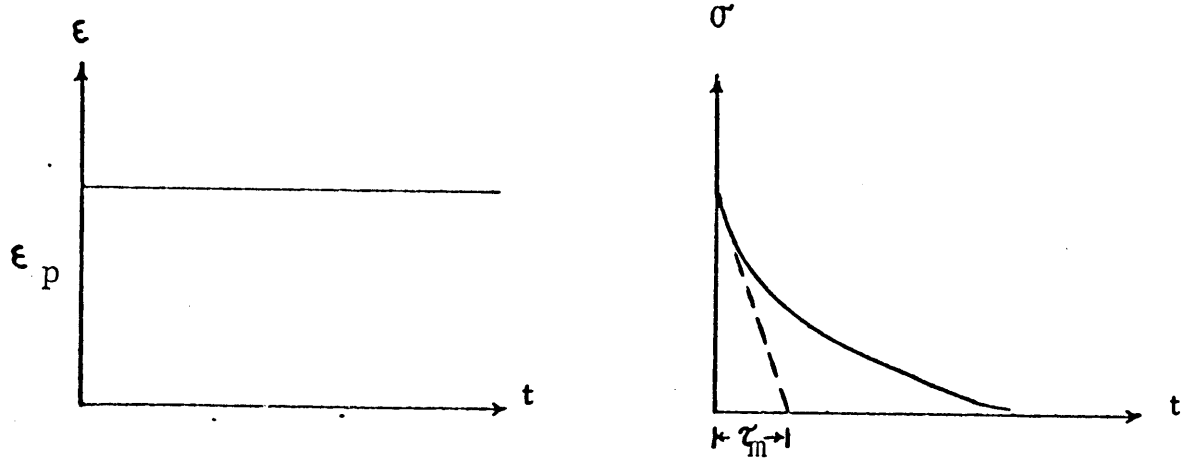

Figure A-3. The Response of Maxwell Unit to a Constant Strain.

The general solution of the above equation is in integral form and can be written as:

$$\varepsilon = \frac{\sigma_o}{E_k}\left(1 - e^{-t/\tau_k}\right) \qquad \text{(A-8)}$$

where: $\tau_k = \eta_k/E_k$

Figure (A-5) shows a plot of this function for $\tau_1 \to \infty$. It can be seen that the strain approaches the purely elastic value σ_o/E_k, for large times.

If the stress σ_o is removed when $\varepsilon = \varepsilon_o$. Then

$$\varepsilon = \varepsilon_o e^{-t/\tau_k}$$

This shows that the recovery proceeds exponentially such that 1/e of the initial strain is unrecovered after a lapse of τ_k units of time. τ_k is called the "Retardation Time" of the unit.

Burger's Model

This model consists of a single Maxwell unit attached in series to a Kelvin or Voigt unit. In a series coupling, the strains and the rates of strains are additive, while the stress is same for both the units. The following equation holds for a Burger's model.

$$\left[D^2\frac{\eta_k}{E_m} + \left(1 + \frac{E_k}{E_m} + \frac{\eta_k}{\eta_m}\right)D + \frac{E_k}{\eta_m}\right]\sigma = \left[\eta_k D^2 + E_k D\right]\varepsilon \qquad \text{(A-9)}$$

where D indicates a derivative with respect to time.

If a constant stress σ_o is applied to the unstrained model at t = 0 the solution of equation (A-9) yields:

$$\varepsilon = \frac{\sigma_o}{E_m} + \frac{\sigma_o}{\eta_m} + \frac{\sigma_o}{E_k}\left(1 - e^{-t/\tau_k}\right) \qquad \text{(A-10)}$$

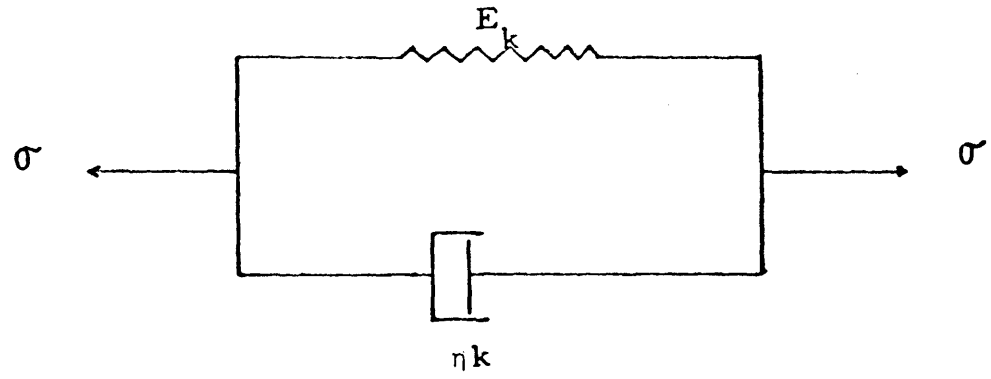

Figure A-4. The Voigt Unit.

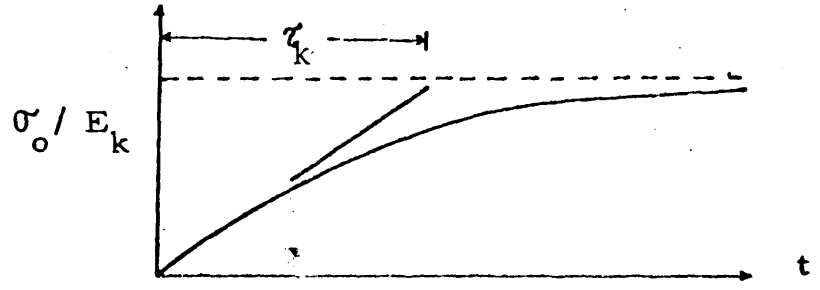

Figure A-5. Strain Response to a Stress Pulse for $t_1 = \infty$.

where: $\tau_k = \frac{\eta_k}{E_k}$.

The arrangement and the response of a Burger's model to a constant stress pulse are shown in Figures (A-6) and (A-7) respectively.

The quantitative representation of the behavior of a viscoelastic material requires the use of more complicated models. However, a viscoelastic body may be uniquely represented either by an infinite number of Kelvin units connected in series with a single Maxwell unit, or by an infinite number of Maxwell units connected in parallel with a single Kelvin unit. For a model with n Kelvin units, connected in series with one Maxwell unit, the deformation under a constant stress σ_o can be given by the following equation:

$$\varepsilon = \frac{\sigma_o}{E_m} + \frac{\sigma_o}{\eta_m} + \frac{\sigma_o}{E_{k_i}} \sum_{i=1}^{n} (1 - e^{-t/\tau_{k_i}}) \qquad \text{(A-11)}$$

By making n sufficiently large, any degree of approximation can be achieved.

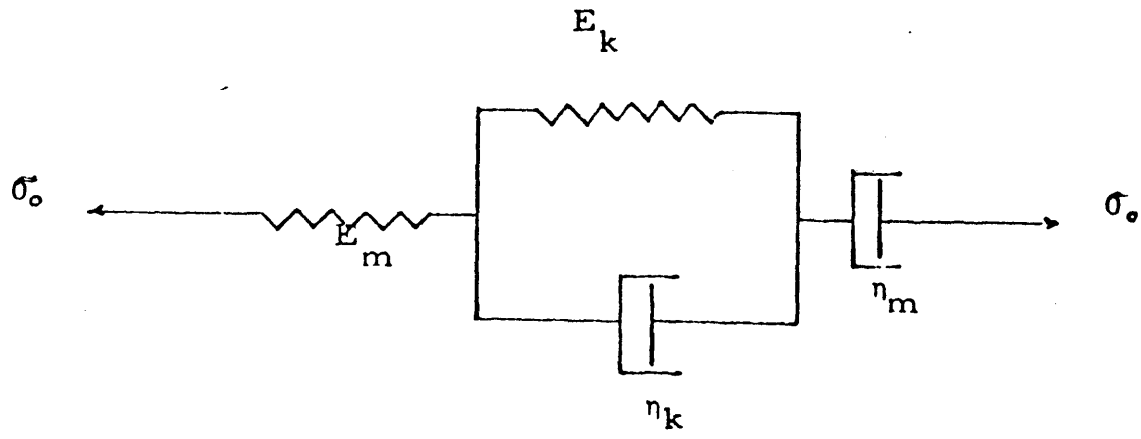

Figure A-6. The Burger's Model.

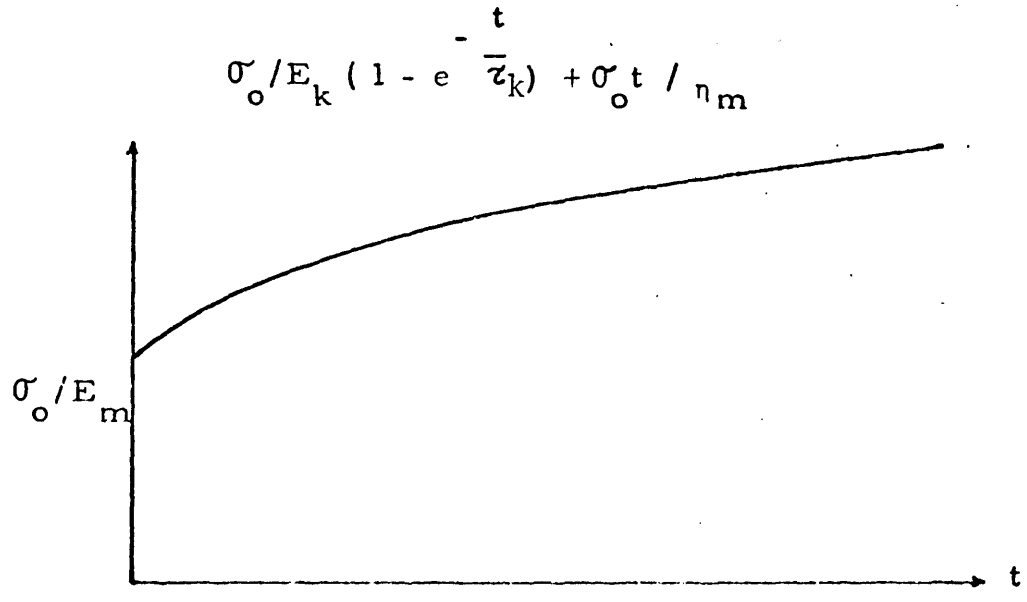

Figure A-7. Strain Response to a Constant Stress Pulse

APPENDIX B

DESIGN DATA DIAGRAMS

Design data diagrams are of particular interest since they are used for determination of constants from the general creep equation of mortar under static loads. Static creep tests each of 30 hours duration were run for different stress levels. The strain-time record of four such tests (Figure B-1) can be represented by the following equation:

$$\varepsilon = c_1\sigma^{\alpha_o} + At^{\beta} + \left[a_2\sigma_{10}^{\alpha_1} t^{\beta} + a_1 \left(\frac{d\varepsilon}{dt}\right)_{10}^{\alpha_2} t \right] \quad \text{(B-1)}$$

where $a_2\sigma_{10}^{\alpha_1} t^{\beta}$ = strain at 10 hours

and $a_1\left(\frac{d\varepsilon}{dt}\right)_{10}^{\alpha_2}$ = strain rate per hour.

The stress index and constant c_1 of the first term of equation is determined by plotting log strain vs. log stress at zero time (Figure B-2). The time index β of the transient state, represented by the second term of the equation is determined by plotting strain vs. time on log-log paper (Figure B-3). The constant A, determined from Figure B-2, is a function of stress. The manner in which A varies is shown in Figure B-4. This relationship between log strain and log stress at unit time is nearly linear and as such can be expressed by the following equation:

$$A = a\sigma^{\alpha_1}$$

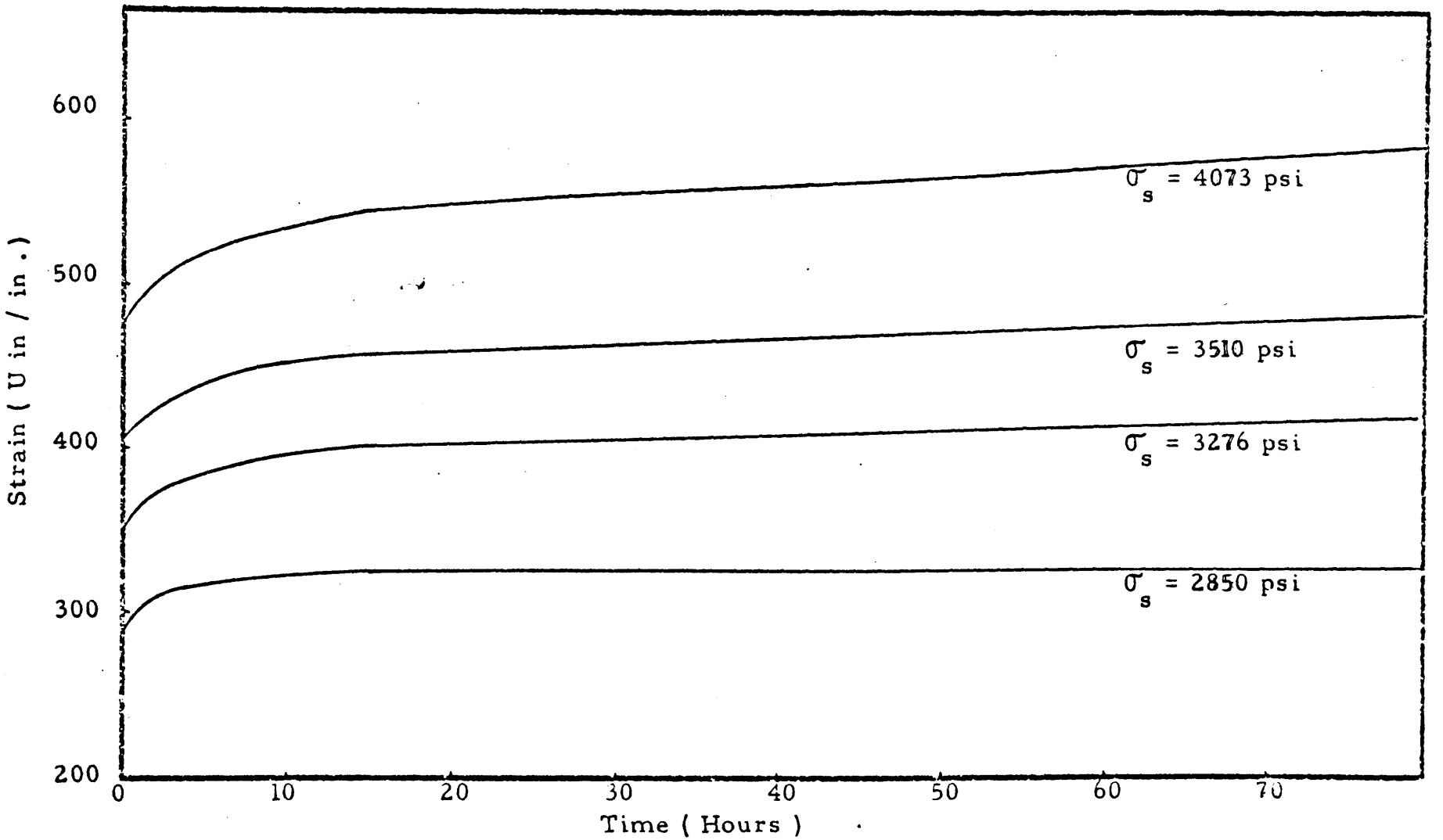

Figure B-1. Constant - Stress Creep Behavior of Mortar.

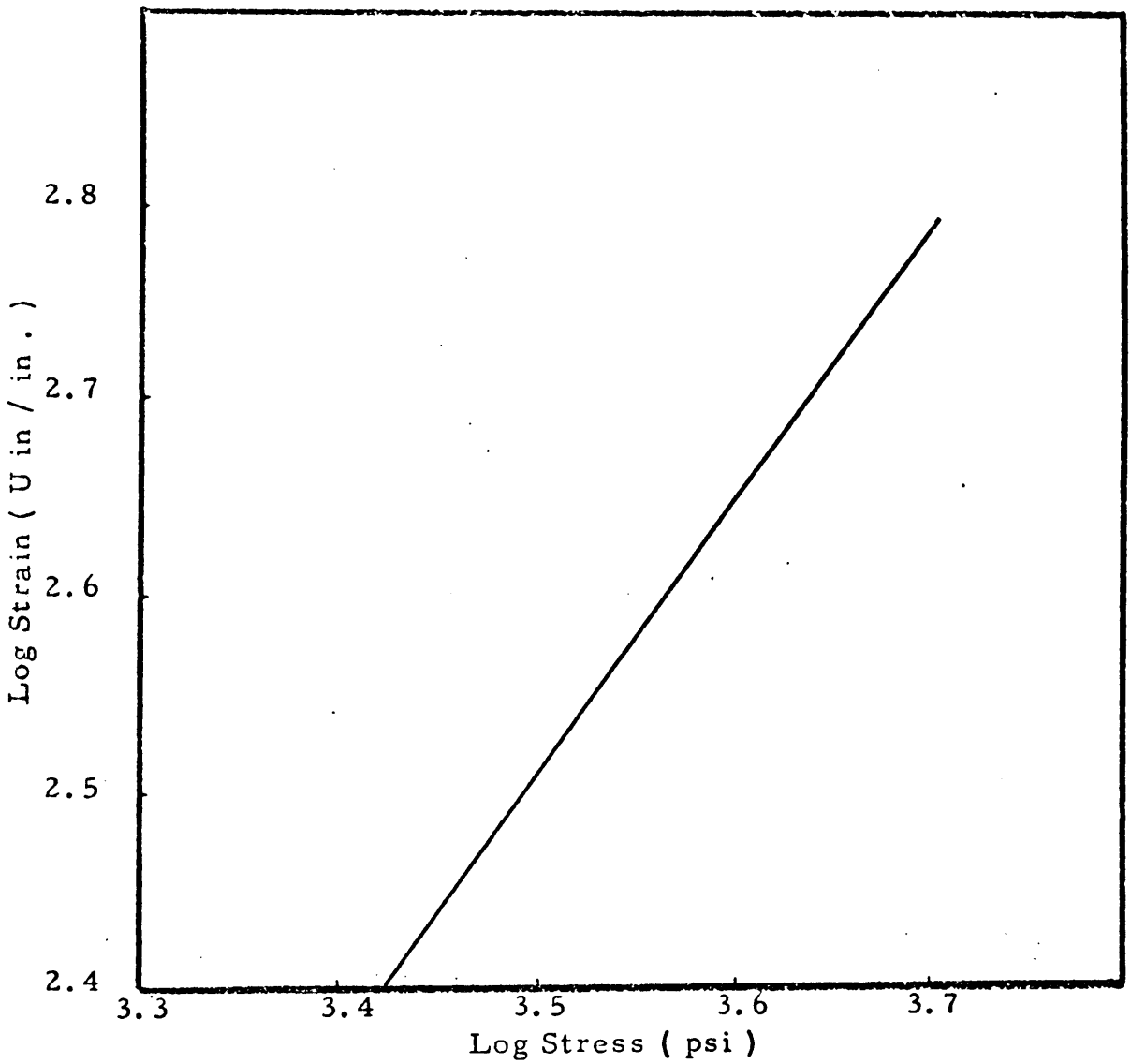

Figure E-2. Constant - Stress Creep Behavior of Mortar at Zero Hour.

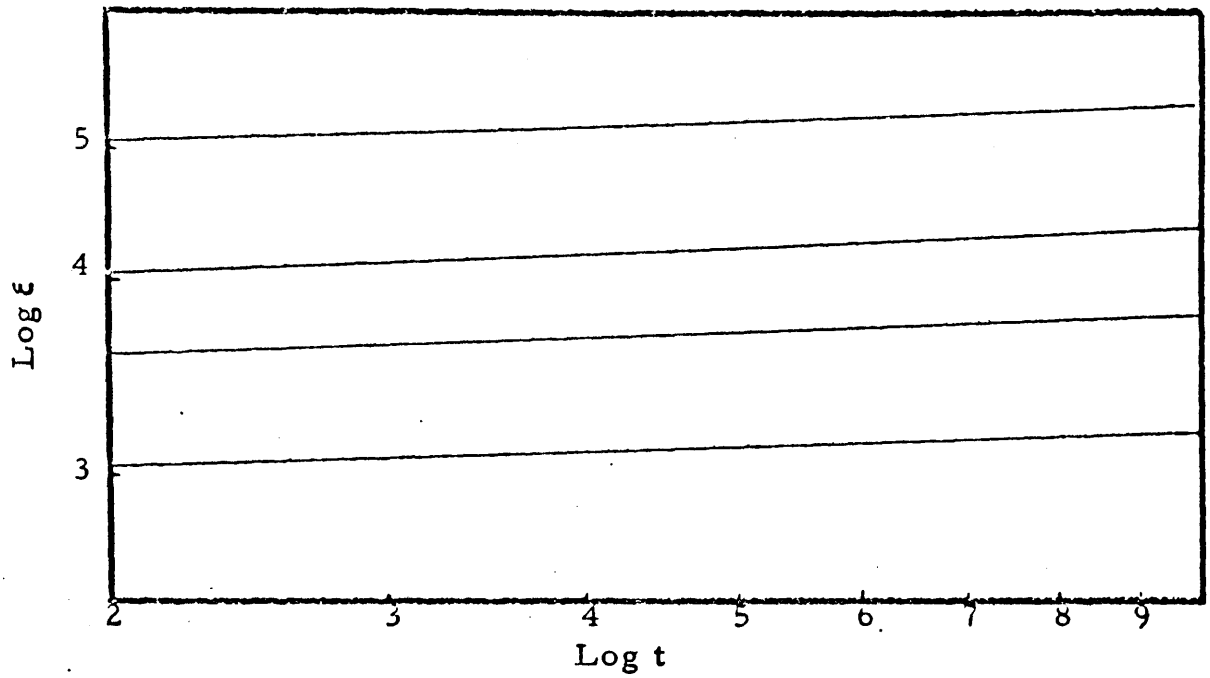

Figure B-3 Constant-Stress Creep Behavior of Mortar.

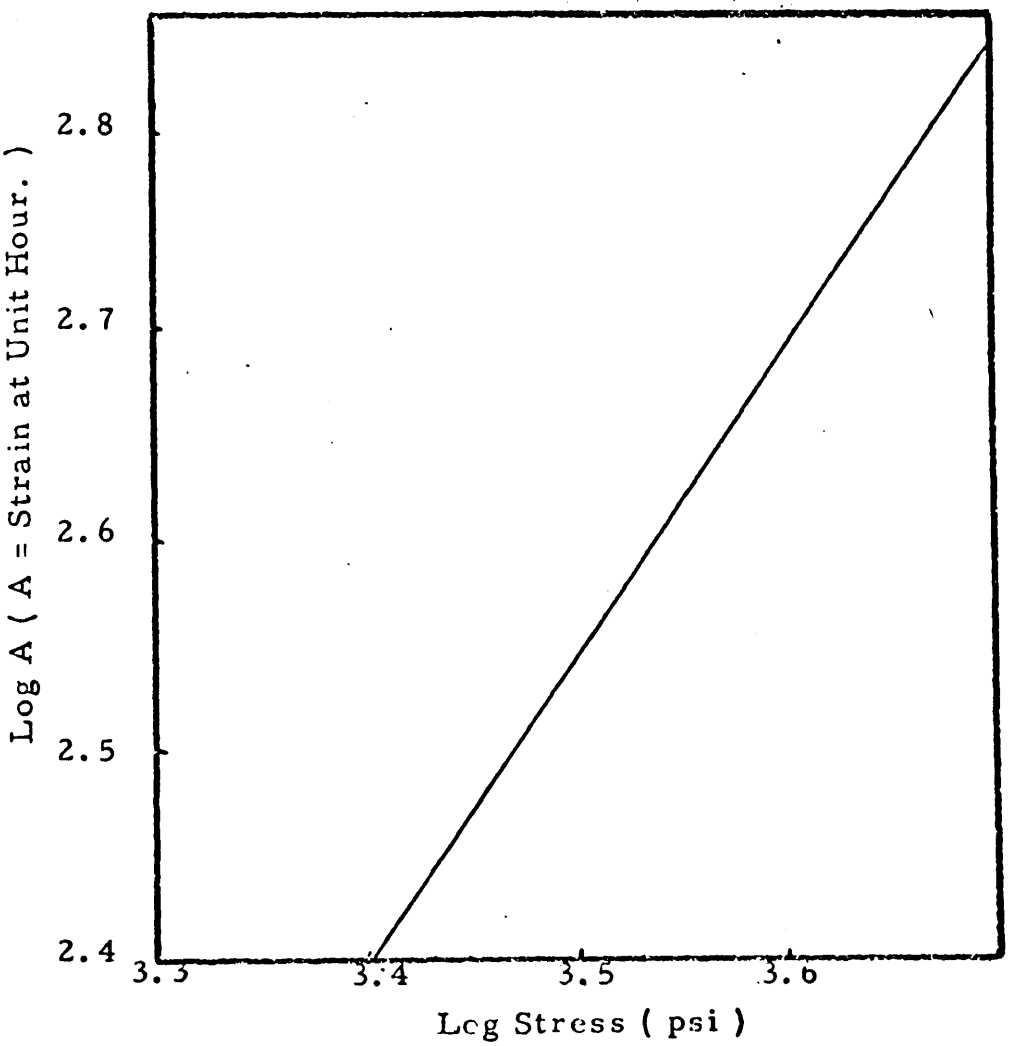

Figure B-4. Cross plot of Figure-B-1 at One Hour.

where a is constant and α_1 is the stress index in the transient state. The transient state can now be represented completely by the second term of equation B-1.

The steady state portion of equation B-1 is represented by the third term. The strain rate at 10 hours is determined by plotting log strain vs. log stress (Figure B-5). The total steady state strain after 10 hours can be represented by the number of hours elapsed beyond 10 hours. The values of various constants determined by the above methods are:

$$c_1 = 0.0019519$$

$$a = 0.00615$$

$$a_1 = 0.59171 \times 10^{-16}$$

$$\alpha_o = 1.49$$

$$\alpha_1 = 1.3576$$

$$\alpha_2 = 4.48$$

$$\beta = 0.0417$$

$$\frac{\alpha_1}{\beta} = 32.556$$

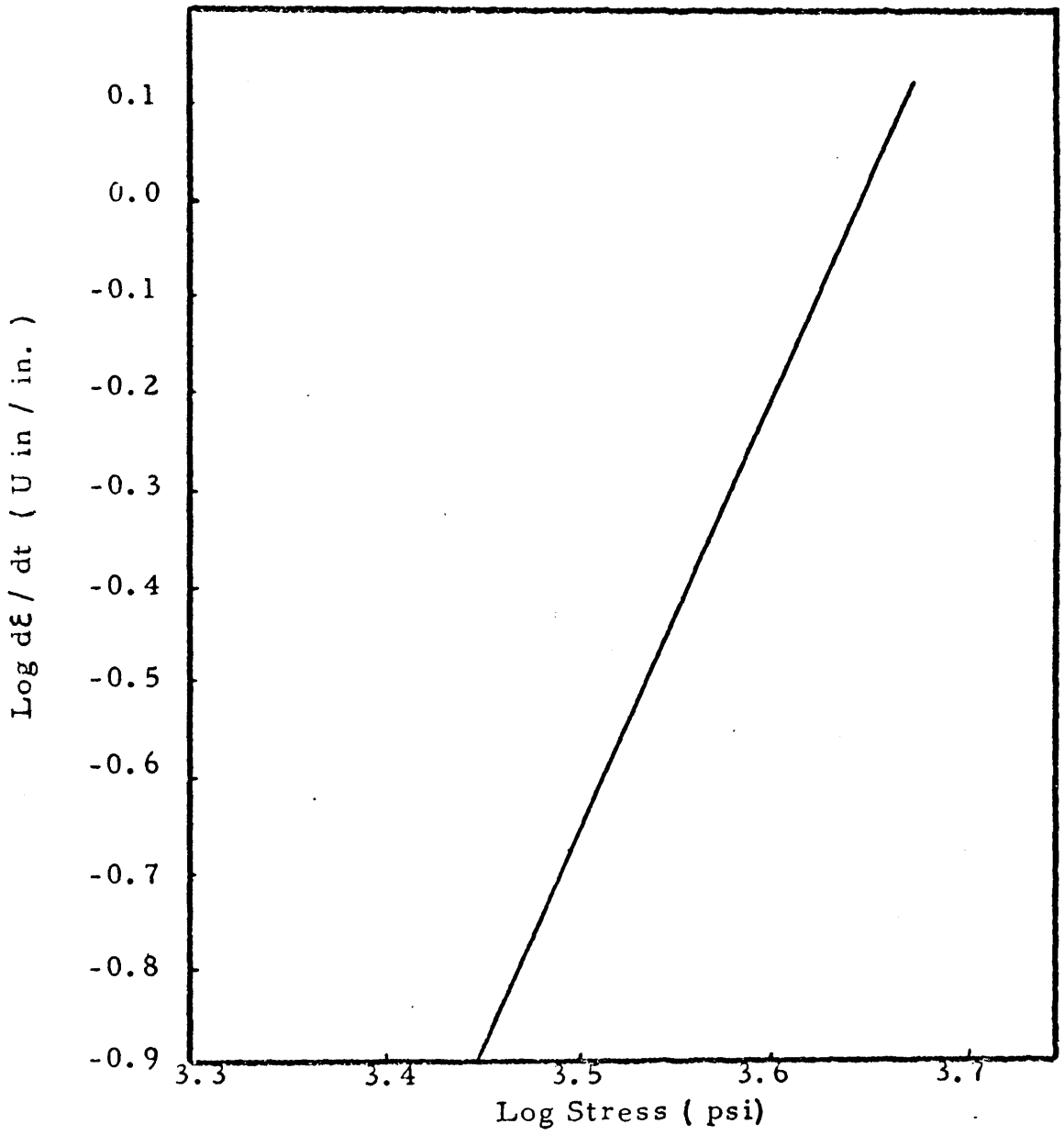

Figure B-5. Constant-Stress Creep Behavior of Mortar at I0 Hours.

APPENDIX C

PROGRAM I

THEORETICAL CALCULATION OF DYNAMIC PARAMETERS V" AND E" FOR VARIOUS VALUES OF α_1/β RATIO

```
      ALPHA=CONSTANT INDEPENDENT OF STRESS AND TIME
      BETA=TIME INDEX
      KK=ALPHA/BETA
      A=ALTERNATING STRESS/STATIC STRESS
      X,C,Z AND D =ANGULAR FREQUENCY MULTIPLIED BY TIME
      TI(K)=VALUE OF INTEGRAL I
      STS=STATIC STRESS,TAKEN AS 1.0
      EQS=EQUIVALENT STATIC STRESS
      DIMENSION F(200),S(200),TI(200)
    1 READ(1,10)A
      WRITE(3,11)
      WRITE(3,9)
      WRITE(3,3)A
      WRITE(3,4)
      KK=1
      DO 2 K=1,35
      T=0.0
      G=0.0
      X=0.0
      N=200
      R=(1.0+A*SIN(X))**KK
      C=6.2831853
      FT=(1.0+A*SIN(C))**KK
      H=(C-X)/200.0
      L=N-1
      DO 5 I=1,L,2
      P=I
      Z=X+P*H
      F(I)=(1.0+A*SIN(Z))**KK
    5 G=G+F(I)
      L=N-2
      DO 7 J=2,L,2
      P=J
      D=X+P*H
      S(J)=(1.0+A*SIN(D))**KK
    7 T=T+S(J)
      TI(K)=((C-X)/3769.91118)*(R+FT+4.0*G+2.0*T)
      Q=KK
      STS=1
      EQS=STS*TI(K)**(1/Q)
```

```
      E=1./EQS
      V=A/EQS
      WRITE(3,8)KK,EQS,E,V
      KK=KK+1
    2 CONTINUE
      IF(A-90.)1,20,20
   20 CALL EXIT
    3 FORMAT(41X39HALTERNATING STRESS/STATIC STRESS RATIO=,F6.2)
    4 FORMAT(/30X2HKK,17X3HEQS,23X1HE,22X1HV/)
    8 FORMAT(29X13,12XF10.4,14XF10.4,14XF10.4,14XF10.4)
    9 FORMAT(/50X17HSTATIC STRESS=1.0/)
   10 FORMAT(E18.8)
   11 FORMAT('1'/54X,'TABLE'/)
      END
```

PROGRAM II

THEORETICAL CALCULATION OF DYNAMIC CREEP OF MORTAR AT ZERO TIME.

```
      DO 100 NT=1,5
      KK=500
      WRITE(3,5)
    5 FORMAT('1'///////,42X'TABLE'/)
      WRITE(3,4)
      WRITE(3,12)
      WRITE(3,13)
      DO 1 K=1,20
      B3=0.0010519
      W1=1.49
      B4=KK
      A=4.0
      EQS=KK
      AL=A*B4
      V=(B3*(B4**(W1)))
      WRITE(3,8)KK,AL,EQS,V
      KK=KK+250.
    1 CONTINUE
  100 CONTINUE
      CALL EXIT
    4 FORMAT(/,'                                        TIME IN HOURS =
     1  0.0'/)
    8 FORMAT(24X15,8X16,5XF12.4,5XF12.4)
   12 FORMAT(26X6HSTATIC,4X11HALTERNATING,3X10HEQUIVALENT,8X7HDYNAMIC)
   13 FORMAT(23X10HSTRESS PSI,2X10HSTRESS PSI,4X10HSTRESS PSI,2X17HSTRAI
     1N MICROIN/IN/)
      END
```

PROGRAM III

THEORETICAL CALCULATION OF DYNAMIC CREEP OF MORTAR BASED ON CONSTANT STRESS CREEP DATA

"TRANSIENT SOLUTION"

```
      DIMENSION F(60),S(60),TI(60),S1(60),S2(60),F1(60),F2(60)
    1 READ(1,10)U1,U2
      DO 100 NT=1,4
      A=0.1
      WRITE(3,4)
    4 FORMAT('1',////////,51X,'TABLE'/)
      WRITE(3,29)A
   29 FORMAT(28X38HALTERNATING STRESS / STATIC STRESS =A=,4XF6.2)
      WRITE(3,11)U1,U2
      WRITE(3,12)
      WRITE(3,13)
      TT=500.
      DO 2 K=1,20
      P=1.3576
      B=0.00615
      E=0.0417
      T=0.0
      G=0.0
      X=0.0
      A=0.1
      N=60
      R2=(1.0+A*SIN(X))**32
      R1=(1.0+A*SIN(X))**33
      R=(R1+R2)/2.
      C=6.2831853
      FT2=(1.0+A*SIN(C))**32
      FT1=(1.0+A*SIN(C))**33
      FT=(FT1+FT2)/2.
      H=(C-X)/60.0
      L=N-1
      DO 5 I=1,L,2
      P=I
      Z=X+P*H
      F2(I)=(1.0+A*SIN(Z))**32
      F1(I)=(1.0+A*SIN(Z))**33
      F(I)=(F1(I)+F2(I))/2.
    5 G=G+F(I)
      L=N-2
      DO 7 J=2,L,2
      P=J
      D=X+P*H
      S2(J)=(1.0+A*SIN(D))**32
      S1(J)=(1.0+A*SIN(D))**33
      S(J)=(S1(J)+S2(J))/2.
```

```
    7 T=T+S(J)
      TI(K)=((C-X)/1130.97354)*(3+TT+4.0*G+2.0*T)
      FOS=TT*TI(K)**(1./3?.5)
      V1=(P*(FOS**(W)))*U1**(E)
      V2=(P*(FOS**(W)))*U2**(E)
      SS=TT*A
      WRITE(3,8)TT,SS,FOS,V1,V2
      TT=TT+250.
    2 CONTINUE
  100 CONTINUE
      IF(U-90.)11,20,20
   20 CONTINUE
      CALL EXIT
    8 FORMAT(14XF6.1,5XF9.1,7XF12.4,5XF12.4,9XF12.4)
   10 FORMAT(2F18.8)
   11 FORMAT(/28X14HTIME IN HOURS=,19XF8.2,12XF8.2//)
   12 FORMAT(15X6HSTATIC,4X11HALTERNATING,8X10HEQUIVALENT,9X7HDYNAMIC,14
     1X7HDYNAMIC)
   13 FORMAT(13X10HSTRESS PSI,3X10HSTRESS PSI,8X10HSTRESS PSI,3X17HSTRAI
     1N MICROIN/IN,6X17HSTRAIN MICROIN/IN/)
      END
```

PROGRAM IV

THEORETICAL CALCULATION OF DYNAMIC CREEP OF MORTAR BASED ON CONSTANT-STRESS CREEP DATA "STEADY STATE SOLUTION"

```
      DIMENSION F(60),S(60),TI(60),S1(60),S2(60),F1(60),F2(60)
    1 READ(1,10)U1,U2
      DO 100 NT=1,4
      A=0.1
      WRITE(3,4)
    4 FORMAT('1'////////,51X,'TABLE'/)
      WRITE(3,29)A
   29 FORMAT(28X38HALTERNATING STRESS / STATIC STRESS =A=,4XF6.2)
      U3=U1+10
      U4=U2+10
      WRITE(3,11)U3,U4
      TT=500.
      WRITE(3,12)
      WRITE(3,13)
      DO 2 K=1,20
      W=1.3576
      B=0.00615
      E=0.0417
```

```
      T=0.0
      G=0.0
      X=0.0
      A=0.1
      N=60
      F2=(1.0+A*SIN(X))**32
      F1=(1.0+A*SIN(X))**33
      F=(F1+F2)/2.
      C=6.2831853
      FT2=(1.0+A*SIN(C))**32
      FT1=(1.0+A*SIN(C))**33
      FT=(FT1+FT2)/2.
      H=(C-X)/60.0
      L=N-1
      DO 5 I=1,L,2
      P=I
      Z=X+P*H
      F2(I)=(1.0+A*SIN(Z))**32
      F1(I)=(1.0+A*SIN(Z))**33
      F(I)=(F1(I)+F2(I))/2.
    5 G=G+F(I)
      L=N-2
      DO 7 J=2,L,2
      P=J
      D=X+P*H
      S2(J)=(1.0+A*SIN(D))**32
      S1(J)=(1.0+A*SIN(D))**33
      S(J)=(S1(J)+S2(J))/2.
    7 T=T+S(J)
      TI(K)=((C-X)/1130.97354)*(R+FT+4.0*G+2.0*T)
      EQS=TT*TI(K)**(1./32.5)
      V=(B*(EQS**(W)))*10.0**(E)
      WW=4.48
      BB=0.56179770E-16
      GK1=(BB*U1*(EQS**(WW)))
      GK2=(BB*U2*(EQS**(WW)))
      VK1=V+GK1
      VK2=V+GK2
      SS=TT*A
      WRITE(3,8)TT,SS,EQS,VK1,VK2
      TT=TT+250.
    2 CONTINUE
  00 CONTINUE
      IF(U-90.)1,20,20
   20 CONTINUE
      CALL EXIT
    8 FORMAT(14XF6.1,5XF9.1,7XF12.4,5XF12.4,9XF12.4)
   10 FORMAT(2E18.8)
   11 FORMAT(/28X14HTIME IN HOURS=,19XF8.2,12XF8.2//)
   12 FORMAT(15X6HSTATIC,4X11HALTERNATING,8X10HEQUIVALENT,9X7HDYNAMIC,14
     1X7HDYNAMIC)
   13 FORMAT(13X10HSTRESS PSI,3X10HSTRESS PSI,8X10HSTRESS PSI,3X17HSTRAI
     1N MICROIN/IN,5X17HSTRAIN MICROIN/IN/)
      END
```

APPENDIX D

THEORETICAL RESULTS OF DYNAMIC CREEP OF MORTAR FOR VARIOUS VALUES OF STRESS RATIO A

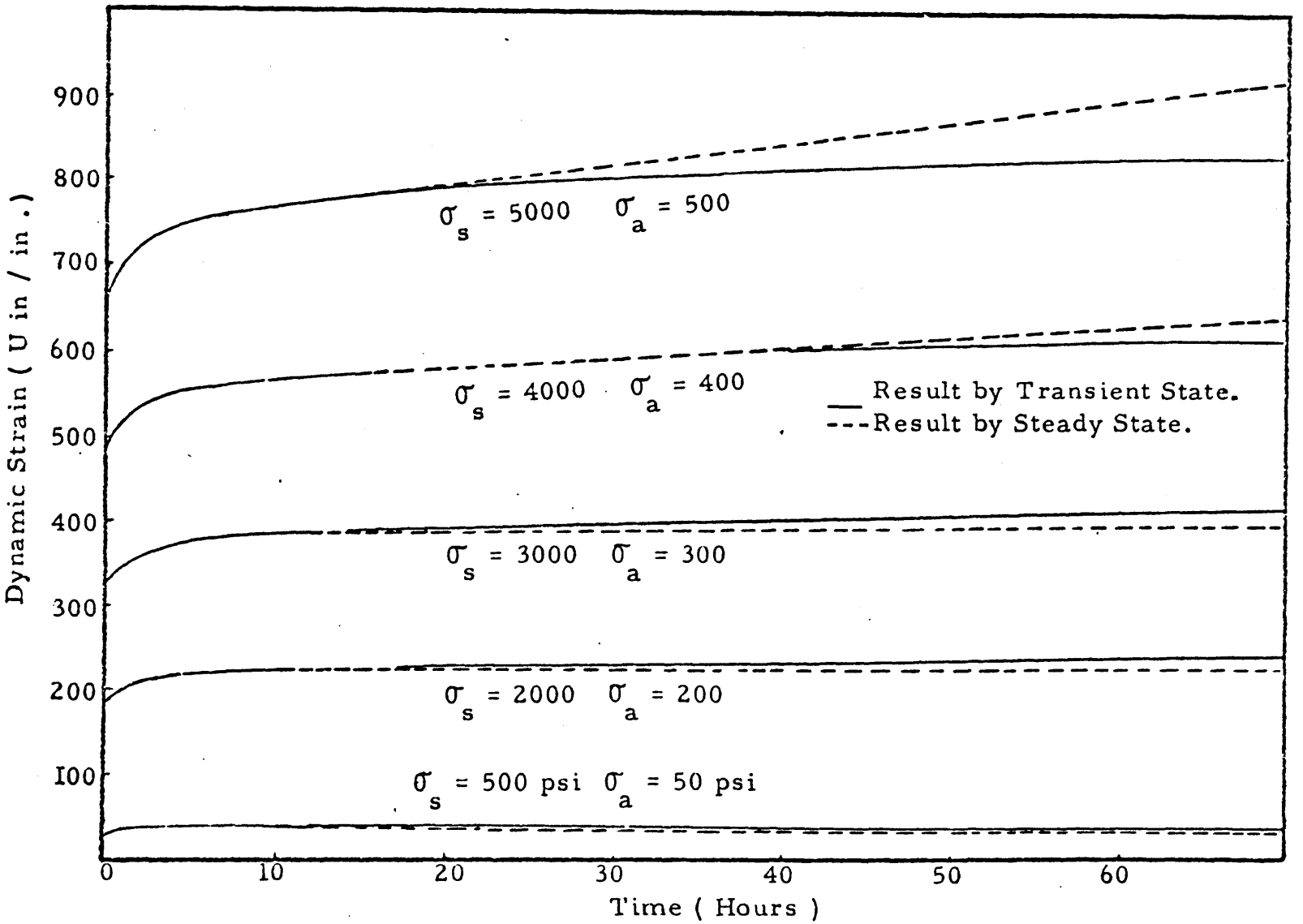

Figure D-1. Dynamic Creep Curves of Mortar under a Dynamic Stress of Stress Ratio A = 0.1

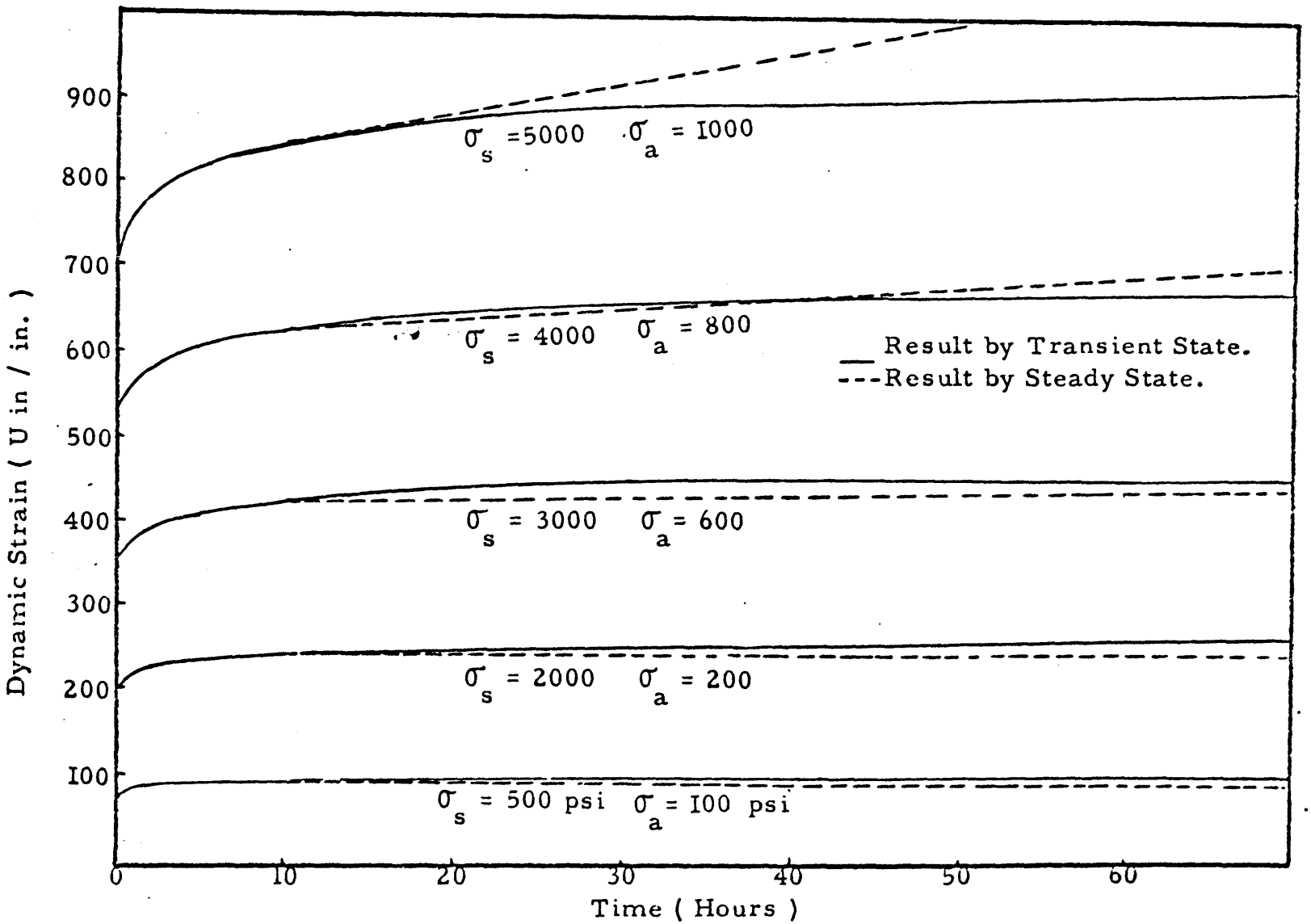

Figure D- 2. Dynamic Creep Curves of Mortar under a Dynamic Stress of Stress Ratio A = 0.2

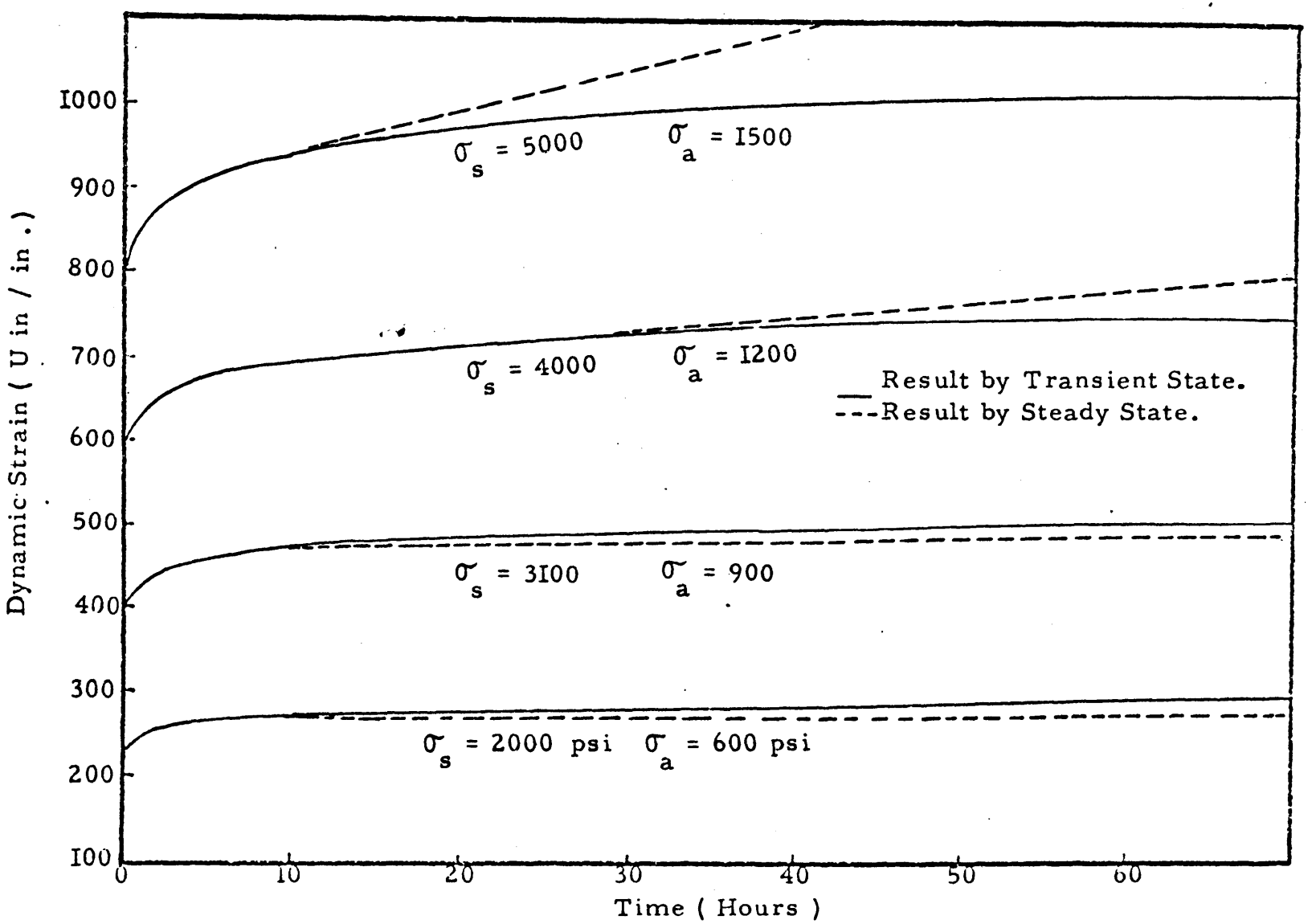

Figure D-3. Dynamic Creep Curves of Mortar under a Dynamic Stress of Stress Ratio A = 0.3

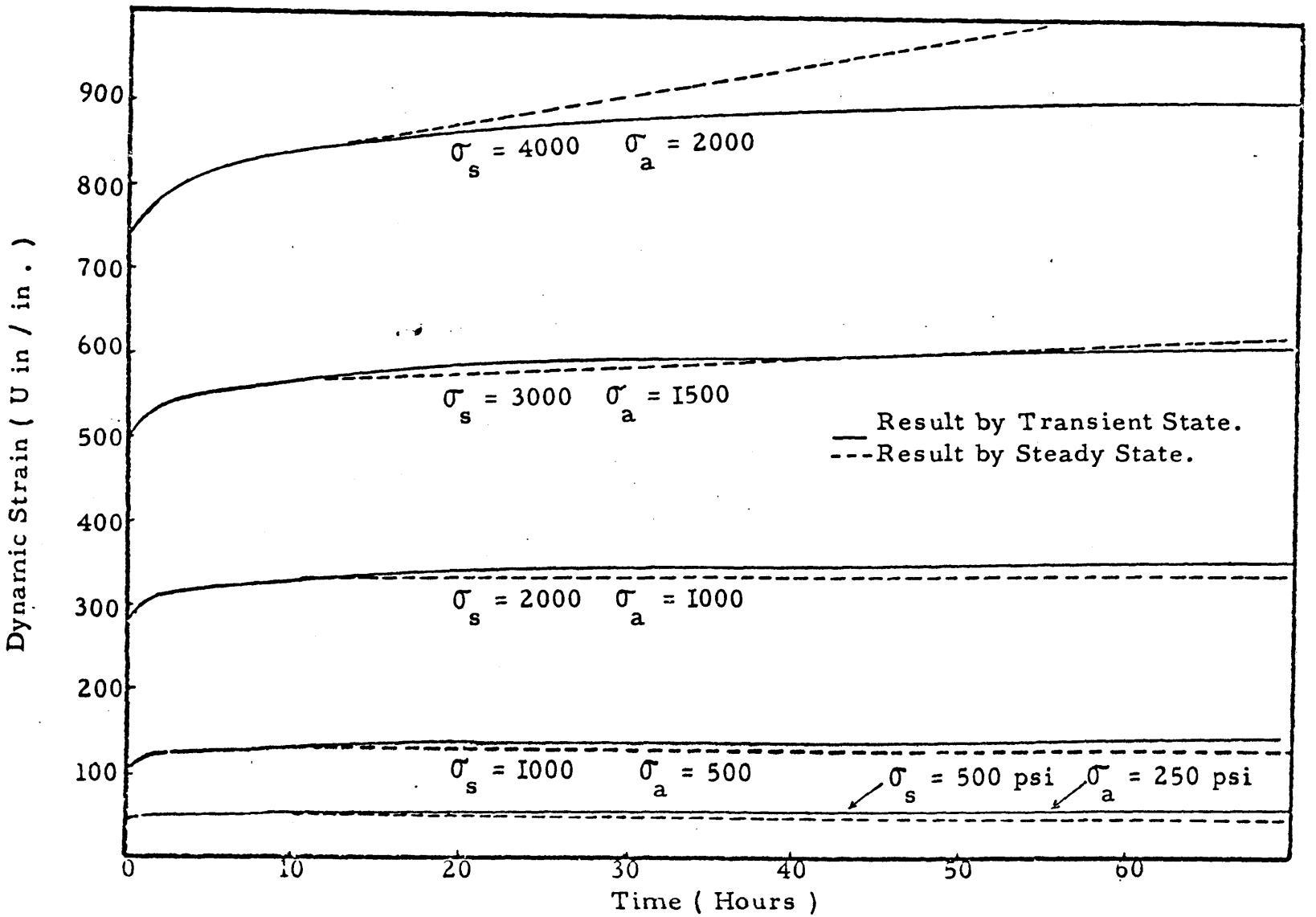

Figure D-4. Dynamic Creep Curves of Mortar under a Dynamic Stress of Stress Ratio A = 0.5

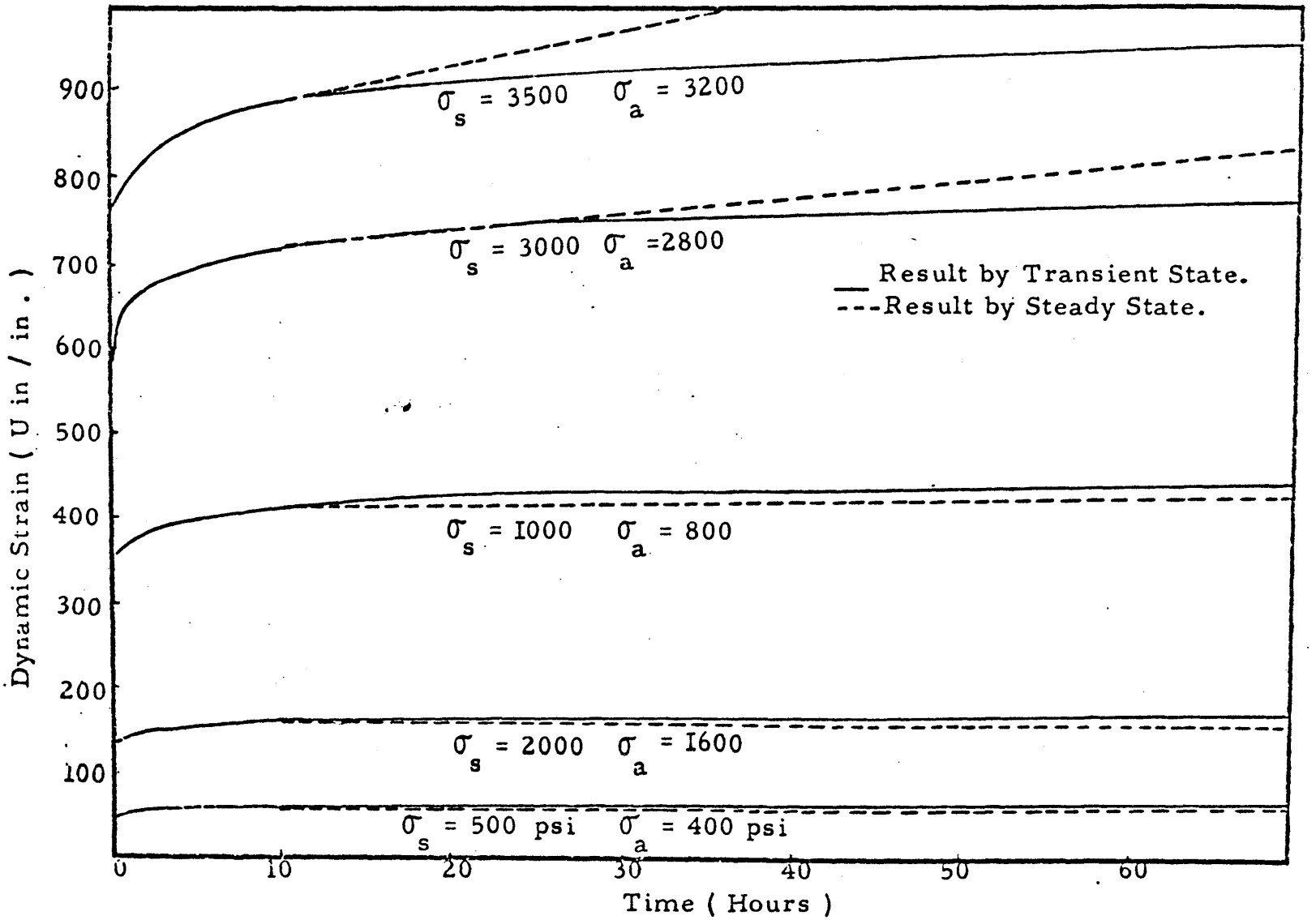

Figure D-5. Dynamic Creep Curves of Mortar under a Dynamic Stress of Stress Ratio A = 0.8

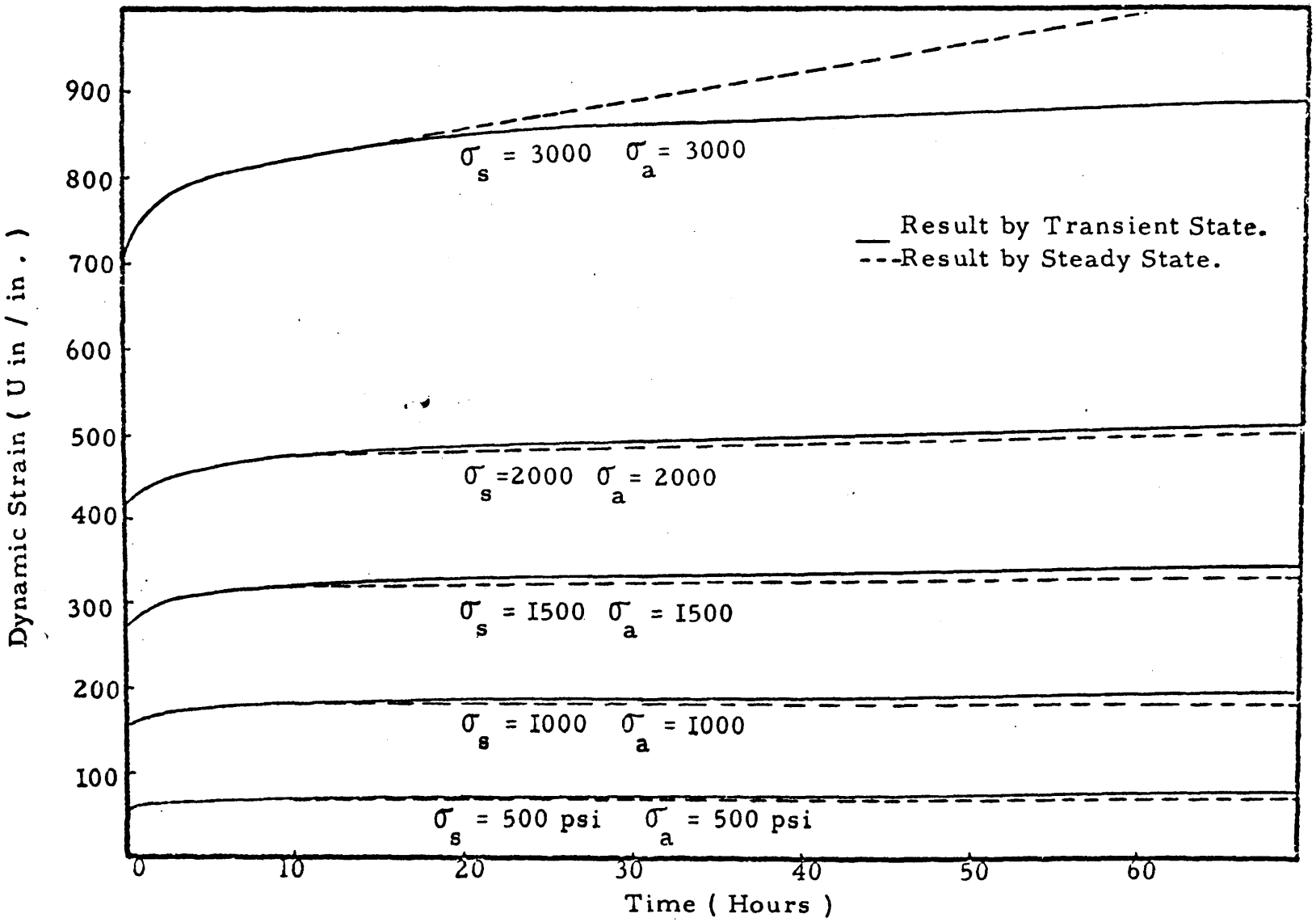

Figure D-6. Dynamic Creep Curves of Mortar under a Dynamic Stress of Stress Ratio A = 1.0

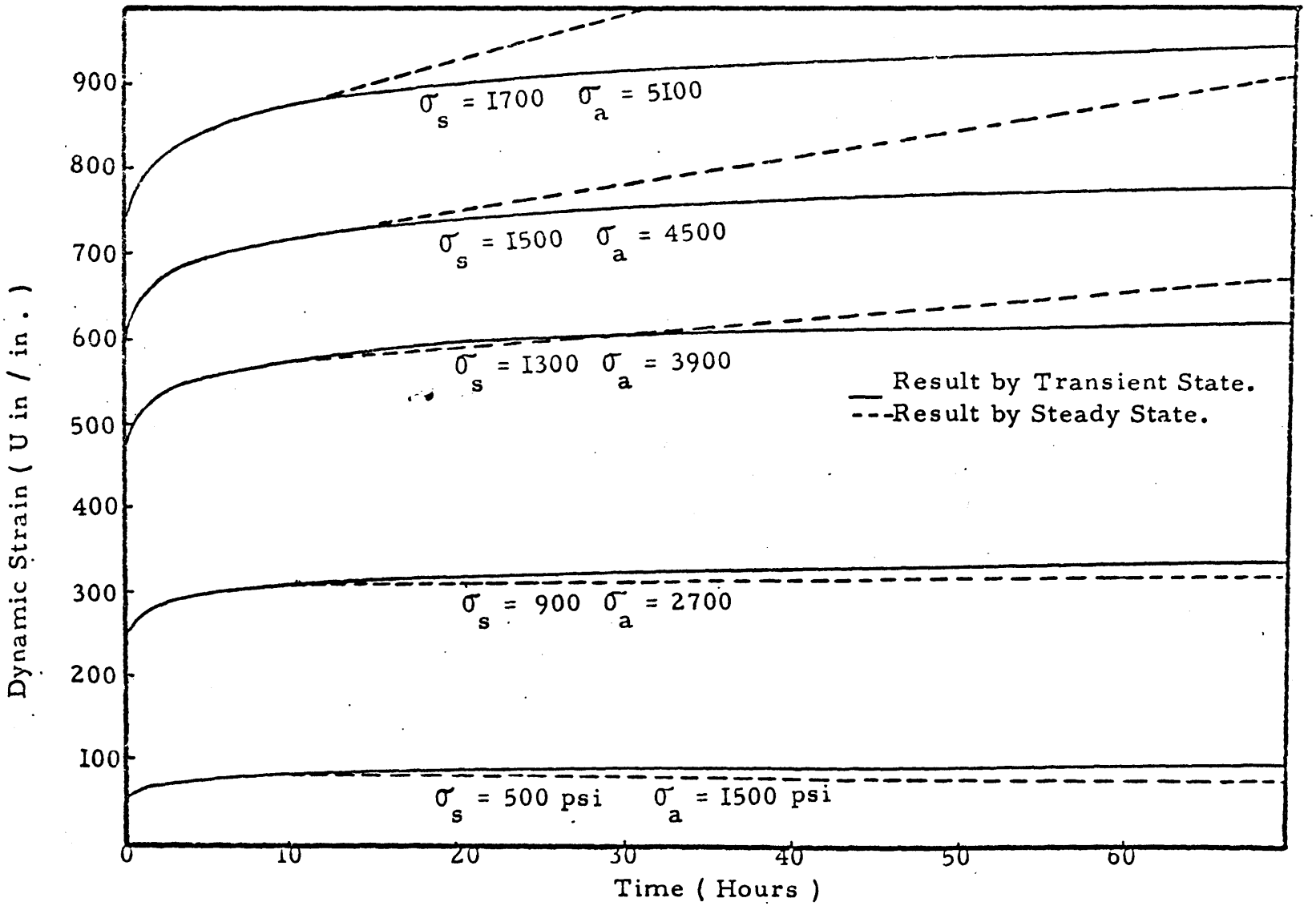

Figure D-7. Dynamic Creep Curves of Mortar under a Dynamic Stress of Stress Ratio A = 3.0

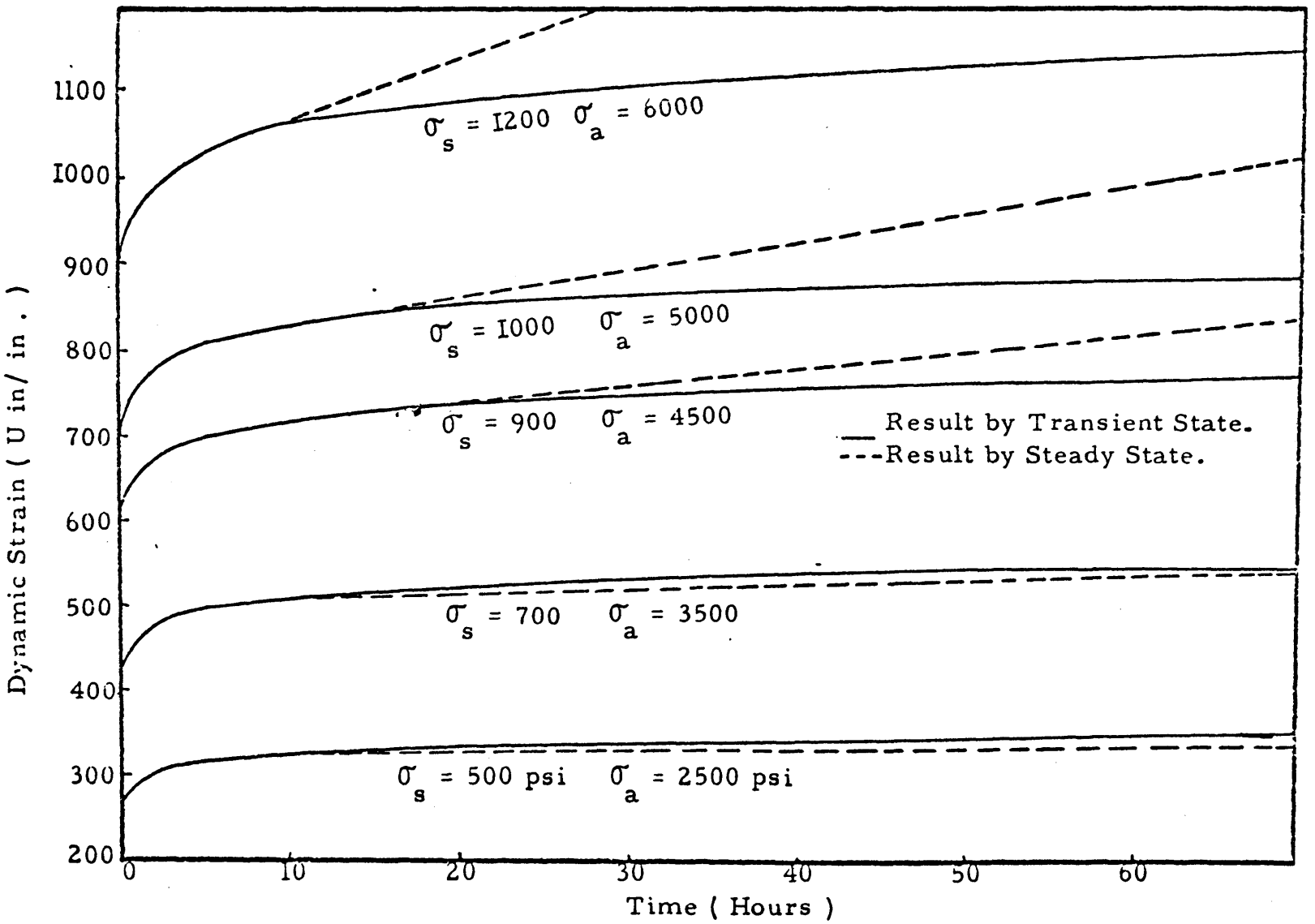

Figure D-8. Dynamic Creep Curves of Mortar under a Dynamic Stress of Stress Ratio A = 5.0

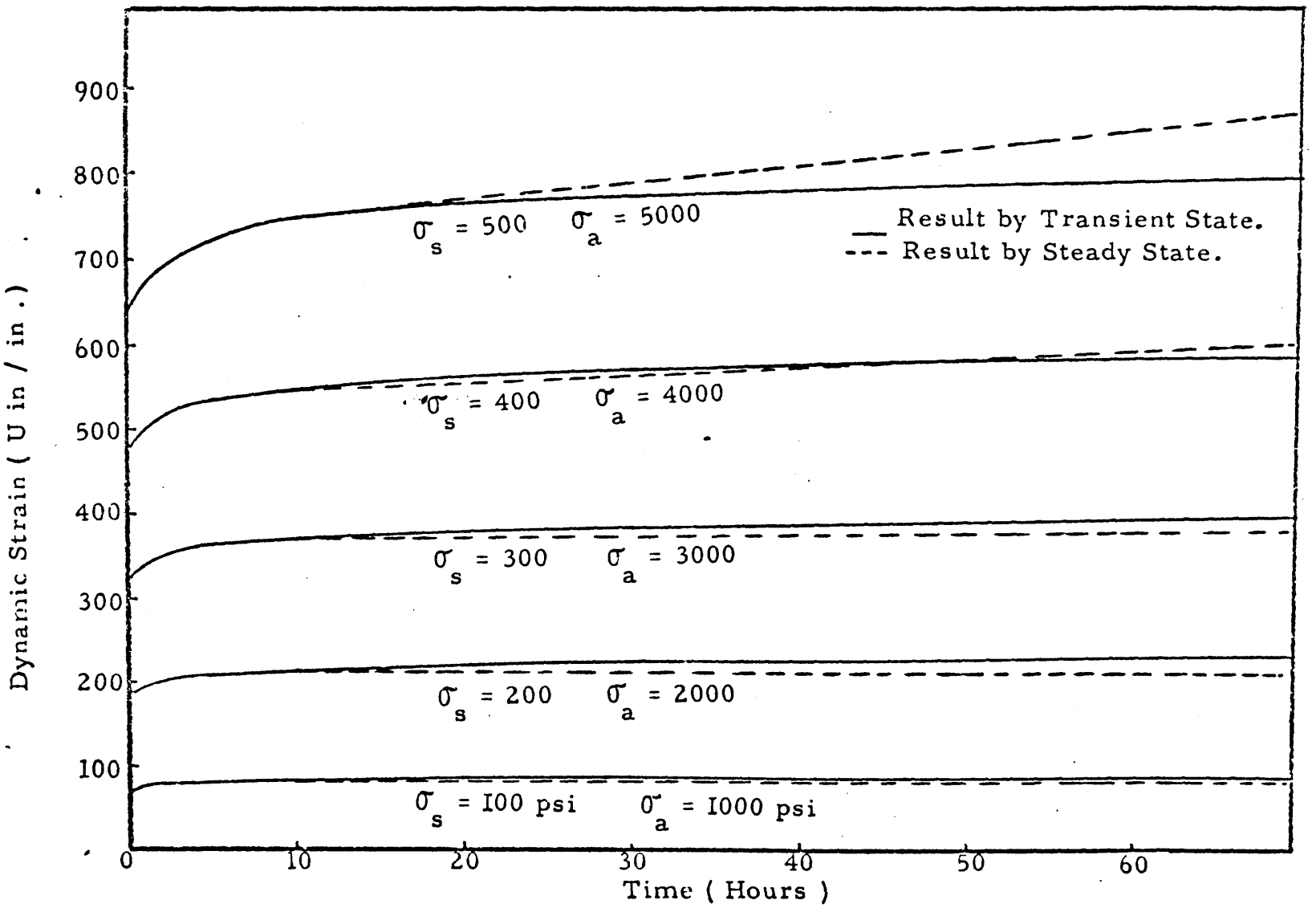

Figure D-9. Dynamic Creep Curves of Mortar under a Dynamic Stress of Stress Ratio A = 10.0

D-I

TABLE D-II

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 0.20

KK	EOS	F''	y''
1	1.0001	1.0000	0.2000
2	1.0099	0.9902	0.1980
3	1.0186	0.9808	0.1962
4	1.0279	0.9719	0.1944
5	1.0377	0.9637	0.1927
6	1.0458	0.9561	0.1912
7	1.0536	0.9491	0.1898
8	1.0607	0.9428	0.1886
9	1.0673	0.9369	0.1874
10	1.0734	0.9316	0.1863
11	1.0790	0.9268	0.1854
12	1.0841	0.9224	0.1845
13	1.0888	0.9184	0.1837
14	1.0932	0.9147	0.1829
15	1.0973	0.9114	0.1823
16	1.1012	0.9083	0.1817
17	1.1044	0.9054	0.1811
18	1.1077	0.9028	0.1806
19	1.1106	0.9004	0.1801
20	1.1134	0.8981	0.1796
21	1.1160	0.8960	0.1792
22	1.1185	0.8941	0.1788
23	1.1208	0.8923	0.1785
24	1.1229	0.8905	0.1781
25	1.1249	0.8889	0.1778
26	1.1269	0.8874	0.1775
27	1.1287	0.8860	0.1772
28	1.1304	0.8847	0.1769
29	1.1320	0.8834	0.1767
30	1.1335	0.8822	0.1764
31	1.1350	0.8811	0.1762
32	1.1364	0.8800	0.1760
33	1.1377	0.8789	0.1758
34	1.1390	0.8780	0.1756
35	1.1402	0.8770	0.1754

TABLE D-III

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 0.30

KK	EOS	EU	VU
1	1.0000	1.0000	0.3000
2	1.0222	0.9782	0.2935
3	1.0431	0.9587	0.2876
4	1.0522	0.9414	0.2824
5	1.0704	0.9265	0.2779
6	1.0847	0.9135	0.2741
7	1.1002	1.9024	0.2707
8	1.1202	0.8927	0.2678
9	1.1307	0.8844	0.2653
10	1.1401	0.8771	0.2631
11	1.1485	0.8707	0.2612
12	1.1560	0.8651	0.2595
13	1.1627	0.8601	0.2580
14	1.1688	0.8556	0.2567
15	1.1743	0.8516	0.2555
16	1.1793	0.8480	0.2544
17	1.1838	0.8447	0.2534
18	1.1881	0.8417	0.2525
19	1.1920	0.8390	0.2517
20	1.1956	0.8364	0.2509
21	1.1990	0.8340	0.2502
22	1.2021	0.8319	0.2496
23	1.2050	0.8299	0.2490
24	1.2077	0.8280	0.2484
25	1.2103	0.8263	0.2479
26	1.2127	0.8246	0.2474
27	1.2150	0.8231	0.2469
28	1.2171	0.8216	0.2465
29	1.2191	0.8203	0.2461
30	1.2210	0.8190	0.2457
31	1.2228	0.8178	0.2453
32	1.2246	0.8166	0.2450
33	1.2262	0.8155	0.2447
34	1.2278	0.8145	0.2443
35	1.2293	0.8135	0.2440

TABLE D-IV

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 0.40

KK	COS	F''	V''
1	1.0000	1.0000	0.4000
2	1.0392	0.9623	0.3849
3	1.0743	0.9308	0.3723
4	1.1048	0.9052	0.3621
5	1.1307	0.8844	0.3538
6	1.1527	0.8676	0.3470
7	1.1713	0.8537	0.3415
8	1.1873	0.8423	0.3369
9	1.2010	0.8326	0.3331
10	1.2129	0.8244	0.3298
11	1.2234	0.8174	0.3270
12	1.2327	0.8113	0.3245
13	1.2409	0.8059	0.3224
14	1.2483	0.8011	0.3204
15	1.2549	0.7969	0.3187
16	1.2609	0.7931	0.3172
17	1.2664	0.7896	0.3158
18	1.2715	0.7865	0.3146
19	1.2761	0.7836	0.3135
20	1.2804	0.7810	0.3124
21	1.2843	0.7786	0.3115
22	1.2880	0.7764	0.3106
23	1.2914	0.7744	0.3097
24	1.2946	0.7724	0.3090
25	1.2976	0.7707	0.3083
26	1.3004	0.7690	0.3076
27	1.3030	0.7674	0.3070
28	1.3055	0.7660	0.3064
29	1.3079	0.7646	0.3058
30	1.3101	0.7633	0.3053
31	1.3122	0.7621	0.3048
32	1.3142	0.7609	0.3044
33	1.3161	0.7598	0.3039
34	1.3179	0.7588	0.3035
35	1.3197	0.7578	0.3031

TABLE D-V

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 0.50

KK	SOS	Eu	Vu
1	1.0000	1.0000	0.5000
2	1.0607	0.9428	0.4714
3	1.1120	0.8993	0.4496
4	1.1540	0.8666	0.4333
5	1.1881	0.8417	0.4208
6	1.2159	0.8224	0.4112
7	1.2389	0.8072	0.4036
8	1.2581	0.7948	0.3974
9	1.2745	0.7846	0.3923
10	1.2886	0.7761	0.3880
11	1.3008	0.7688	0.3844
12	1.3116	0.7625	0.3812
13	1.3211	0.7570	0.3785
14	1.3296	0.7521	0.3761
15	1.3372	0.7478	0.3739
16	1.3441	0.7440	0.3720
17	1.3504	0.7405	0.3703
18	1.3562	0.7374	0.3687
19	1.3614	0.7345	0.3673
20	1.3663	0.7319	0.3660
21	1.3708	0.7295	0.3648
22	1.3750	0.7273	0.3636
23	1.3788	0.7252	0.3626
24	1.3825	0.7233	0.3617
25	1.3859	0.7216	0.3608
26	1.3890	0.7199	0.3600
27	1.3920	0.7184	0.3592
28	1.3948	0.7169	0.3585
29	1.3975	0.7156	0.3578
30	1.4000	0.7143	0.3571
31	1.4024	0.7131	0.3565
32	1.4046	0.7119	0.3560
33	1.4068	0.7109	0.3554
34	1.4088	0.7098	0.3549
35	1.4107	0.7088	0.3544

TABLE D-VI

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 0.60

KK	FOS	F"	V"
1	1.0000	1.0000	0.6000
2	1.0863	0.9206	0.5523
3	1.1543	0.8660	0.5196
4	1.2079	0.8279	0.4967
5	1.2493	0.8005	0.4803
6	1.2822	0.7799	0.4679
7	1.3089	0.7640	0.4584
8	1.3311	0.7513	0.4508
9	1.3498	0.7409	0.4445
10	1.3657	0.7322	0.4393
11	1.3796	0.7249	0.4349
12	1.3917	0.7186	0.4311
13	1.4024	0.7131	0.4278
14	1.4119	0.7083	0.4250
15	1.4205	0.7040	0.4224
16	1.4282	0.7002	0.4201
17	1.4352	0.6967	0.4180
18	1.4417	0.6936	0.4162
19	1.4475	0.6908	0.4145
20	1.4529	0.6883	0.4130
21	1.4579	0.6859	0.4115
22	1.4626	0.6837	0.4102
23	1.4669	0.6817	0.4090
24	1.4709	0.6799	0.4079
25	1.4747	0.6781	0.4069
26	1.4782	0.6765	0.4059
27	1.4815	0.6750	0.4050
28	1.4846	0.6736	0.4041
29	1.4875	0.6723	0.4034
30	1.4903	0.6710	0.4026
31	1.4929	0.6698	0.4019
32	1.4954	0.6687	0.4012
33	1.4978	0.6676	0.4006
34	1.5001	0.6666	0.4000
35	1.5022	0.6657	0.3994

TABLE D-VII

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 0.70

KK	EOS	E"	V"
1	1.0000	1.0000	0.7000
2	1.1158	0.8962	0.6274
3	1.2016	0.8322	0.5825
4	1.2649	0.7906	0.5534
5	1.3128	0.7617	0.5332
6	1.3503	0.7406	0.5184
7	1.3805	0.7244	0.5071
8	1.4053	0.7116	0.4981
9	1.4261	0.7012	0.4909
10	1.4438	0.6926	0.4848
11	1.4592	0.6853	0.4797
12	1.4726	0.6791	0.4754
13	1.4844	0.6737	0.4716
14	1.4949	0.6689	0.4683
15	1.5044	0.6647	0.4653
16	1.5129	0.6610	0.4627
17	1.5206	0.6576	0.4603
18	1.5276	0.6546	0.4582
19	1.5341	0.6519	0.4563
20	1.5400	0.6493	0.4545
21	1.5455	0.6470	0.4529
22	1.5506	0.6449	0.4514
23	1.5553	0.6430	0.4501
24	1.5597	0.6411	0.4489
25	1.5638	0.6395	0.4476
26	1.5677	0.6379	0.4465
27	1.5713	0.6364	0.4455
28	1.5747	0.6350	0.4445
29	1.5779	0.6338	0.4436
30	1.5809	0.6325	0.4428
31	1.5838	0.6314	0.4420
32	1.5865	0.6303	0.4412
33	1.5891	0.6293	0.4405
34	1.5916	0.6283	0.4398
35	1.5939	0.6274	0.4392

TABLE D-VIII

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 0.80

KK	EOS	E"	V"
1	1.0000	1.0000	0.8000
2	1.1489	0.8704	0.6963
3	1.2515	0.7991	0.6393
4	1.3241	0.7553	0.6042
5	1.3780	0.7257	0.5806
6	1.4196	0.7044	0.5635
7	1.4529	0.6883	0.5506
8	1.4803	0.6756	0.5404
9	1.5031	0.6653	0.5322
10	1.5225	0.6568	0.5254
11	1.5393	0.6496	0.5197
12	1.5540	0.6435	0.5148
13	1.5669	0.6382	0.5106
14	1.5784	0.6336	0.5069
15	1.5886	0.6295	0.5036
16	1.5979	0.6258	0.5007
17	1.6063	0.6225	0.4980
18	1.6140	0.6196	0.4957
19	1.6210	0.6169	0.4935
20	1.6274	0.6145	0.4916
21	1.6334	0.6122	0.4898
22	1.6389	0.6102	0.4881
23	1.6440	0.6083	0.4866
24	1.6488	0.6065	0.4852
25	1.6532	0.6049	0.4839
26	1.6574	0.6034	0.4827
27	1.6613	0.6019	0.4815
28	1.6650	0.6006	0.4805
29	1.6685	0.5993	0.4795
30	1.6718	0.5982	0.4785
31	1.6749	0.5971	0.4776
32	1.6778	0.5960	0.4768
33	1.6806	0.5950	0.4760
34	1.6833	0.5941	0.4753
35	1.6858	0.5932	0.4745

TABLE D-X

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 1.00

KK	BOS	E "	V "
1	1.0000	1.0000	1.0000
2	1.2247	0.8165	0.8165
3	1.3572	0.7368	0.7368
4	1.4462	0.6914	0.6914
5	1.5109	0.6618	0.6618
6	1.5604	0.6408	0.6408
7	1.5997	0.6251	0.6251
8	1.6318	0.6128	0.6128
9	1.6585	0.6029	0.6029
10	1.6812	0.5948	0.5948
11	1.7003	0.5880	0.5880
12	1.7178	0.5821	0.5821
13	1.7328	0.5771	0.5771
14	1.7461	0.5727	0.5727
15	1.7580	0.5688	0.5688
16	1.7687	0.5654	0.5654
17	1.7784	0.5623	0.5623
18	1.7872	0.5595	0.5595
19	1.7953	0.5570	0.5570
20	1.8028	0.5547	0.5547
21	1.8096	0.5526	0.5526
22	1.8160	0.5507	0.5507
23	1.8219	0.5489	0.5489
24	1.8274	0.5472	0.5472
25	1.8325	0.5457	0.5457
26	1.8373	0.5443	0.5443
27	1.8418	0.5429	0.5429
28	1.8460	0.5417	0.5417
29	1.8500	0.5405	0.5405
30	1.8538	0.5394	0.5394
31	1.8574	0.5384	0.5384
32	1.8608	0.5374	0.5374
33	1.8640	0.5365	0.5365
34	1.8670	0.5356	0.5356
35	1.8699	0.5348	0.5348

TABLE D-IX

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 0.90

KK	EQS	F"	V"
1	1.0000	1.0000	0.9000
2	1.1053	0.8437	0.7593
3	1.3035	0.7671	0.6904
4	1.3847	0.7222	0.6500
5	1.4441	0.6925	0.6232
6	1.4897	0.6713	0.6041
7	1.5261	0.6553	0.5897
8	1.5558	0.6427	0.5785
9	1.5806	0.6327	0.5694
10	1.6017	0.6243	0.5619
11	1.6199	0.6173	0.5556
12	1.6358	0.6113	0.5502
13	1.6497	0.6062	0.5456
14	1.6621	0.6016	0.5415
15	1.6732	0.5977	0.5379
16	1.6832	0.5941	0.5347
17	1.6923	0.5909	0.5318
18	1.7005	0.5881	0.5293
19	1.7081	0.5855	0.5269
20	1.7150	0.5831	0.5248
21	1.7214	0.5809	0.5228
22	1.7273	0.5789	0.5210
23	1.7329	0.5771	0.5194
24	1.7380	0.5754	0.5178
25	1.7429	0.5738	0.5164
26	1.7473	0.5723	0.5151
27	1.7515	0.5709	0.5138
28	1.7555	0.5697	0.5127
29	1.7592	0.5684	0.5116
30	1.7627	0.5673	0.5106
31	1.7661	0.5662	0.5096
32	1.7692	0.5652	0.5087
33	1.7722	0.5643	0.5078
34	1.7751	0.5633	0.5070
35	1.7778	0.5625	0.5062

TABLE D-XI

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 2.00

KK	EOS	E"	V"
1	1.0000	1.0000	2.0000
2	1.7320	0.5774	1.1547
3	1.9129	0.5228	1.0455
4	2.0878	0.4790	0.9579
5	2.1954	0.4555	0.9110
6	2.2814	0.4383	0.8767
7	2.3476	0.4260	0.8519
8	2.4017	0.4164	0.8327
9	2.4464	0.4088	0.8175
10	2.4843	0.4025	0.8051
11	2.5167	0.3973	0.7947
12	2.5449	0.3929	0.7859
13	2.5696	0.3892	0.7783
14	2.5915	0.3859	0.7718
15	2.6111	0.3830	0.7660
16	2.6286	0.3804	0.7608
17	2.6445	0.3781	0.7563
18	2.6590	0.3761	0.7522
19	2.6722	0.3742	0.7484
20	2.6843	0.3725	0.7451
21	2.6955	0.3710	0.7420
22	2.7059	0.3696	0.7391
23	2.7154	0.3683	0.7365
24	2.7244	0.3671	0.7341
25	2.7327	0.3659	0.7319
26	2.7405	0.3649	0.7298
27	2.7478	0.3639	0.7279
28	2.7546	0.3630	0.7260
29	2.7611	0.3622	0.7243
30	2.7672	0.3614	0.7227
31	2.7730	0.3606	0.7212
32	2.7785	0.3599	0.7198
33	2.7836	0.3592	0.7185
34	2.7886	0.3586	0.7172
35	2.7932	0.3580	0.7160

TABLE D-XII

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 3.00

KK	EOS	F "	V "
1	1.0000	1.0000	3.0000
2	2.3452	0.4264	1.2792
3	2.4385	0.4101	1.2303
4	2.7641	0.3618	1.0853
5	2.8792	0.3473	1.0419
6	3.0155	0.3316	0.9949
7	3.1003	0.3225	0.9676
8	3.1788	0.3146	0.9437
9	3.2393	0.3087	0.9261
10	3.2924	0.3037	0.9112
11	3.3370	0.2997	0.8990
12	3.3761	0.2962	0.8886
13	3.4102	0.2932	0.8797
14	3.4405	0.2907	0.8720
15	3.4675	0.2884	0.8652
16	3.4917	0.2864	0.8592
17	3.5136	0.2846	0.8538
18	3.5335	0.2830	0.8490
19	3.5517	0.2816	0.8447
20	3.5684	0.2802	0.8407
21	3.5838	0.2790	0.8371
22	3.5980	0.2779	0.8338
23	3.6112	0.2769	0.8308
24	3.6234	0.2760	0.8279
25	3.6349	0.2751	0.8253
26	3.6456	0.2743	0.8229
27	3.6556	0.2736	0.8207
28	3.6650	0.2728	0.8185
29	3.6739	0.2722	0.8166
30	3.6823	0.2716	0.8147
31	3.6902	0.2710	0.8130
32	3.6977	0.2704	0.8113
33	3.7048	0.2699	0.8098
34	3.7116	0.2694	0.8083
35	3.7180	0.2690	0.8069

TABLE D-XIII

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 4.00

KK	EQS	F"	V"
1	1.0000	1.0000	4.0000
2	3.0000	0.3333	1.3333
3	2.9240	0.3420	1.3680
4	3.4701	0.2882	1.1527
5	3.5464	0.2820	1.1279
6	3.7634	0.2657	1.0629
7	3.8478	0.2599	1.0395
8	3.8619	0.2524	1.0096
9	4.0313	0.2481	0.9922
10	4.1035	0.2437	0.9748
11	4.1578	0.2405	0.9621
12	4.2090	0.2376	0.9503
13	4.2516	0.2352	0.9408
14	4.2906	0.2331	0.9323
15	4.3247	0.2312	0.9249
16	4.3557	0.2296	0.9183
17	4.3835	0.2281	0.9125
18	4.4089	0.2268	0.9073
19	4.4320	0.2256	0.9025
20	4.4532	0.2246	0.8982
21	4.4727	0.2236	0.8943
22	4.4908	0.2227	0.8907
23	4.5076	0.2218	0.8874
24	4.5231	0.2211	0.8843
25	4.5377	0.2204	0.8815
26	4.5513	0.2197	0.8789
27	4.5640	0.2191	0.8764
28	4.5760	0.2185	0.8741
29	4.5872	0.2180	0.8720
30	4.5979	0.2175	0.8700
31	4.6079	0.2170	0.8681
32	4.6174	0.2166	0.8663
33	4.6265	0.2161	0.8646
34	4.6350	0.2157	0.8630
35	4.6432	0.2154	0.8615

TABLE D-XIV

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 5.00

KK	EQS	E"	V"
1	1.0000	1.0000	5.0000
2	3.6742	0.2722	1.3608
3	3.3766	0.2962	1.4808
4	4.1973	0.2382	1.1912
5	4.1942	0.2384	1.1921
6	4.5252	0.2210	1.1049
7	4.5858	0.2181	1.0903
8	4.7526	0.2104	1.0521
9	4.8189	0.2075	1.0376
10	4.9184	0.2033	1.0166
11	4.9768	0.2009	1.0047
12	5.0440	0.1983	0.9913
13	5.0925	0.1964	0.9818
14	5.1419	0.1945	0.9724
15	5.1819	0.1930	0.9649
16	5.2204	0.1916	0.9578
17	5.2536	0.1903	0.9517
18	5.2847	0.1892	0.9461
19	5.3125	0.1882	0.9412
20	5.3384	0.1873	0.9366
21	5.3620	0.1865	0.9325
22	5.3839	0.1857	0.9287
23	5.4042	0.1850	0.9252
24	5.4231	0.1844	0.9220
25	5.4407	0.1838	0.9190
26	5.4572	0.1832	0.9162
27	5.4726	0.1827	0.9136
28	5.4871	0.1822	0.9112
29	5.5008	0.1818	0.9090
30	5.5137	0.1814	0.9068
31	5.5258	0.1810	0.9048
32	5.5374	0.1806	0.9030
33	5.5483	0.1802	0.9012
34	5.5587	0.1799	0.8995
35	5.5685	0.1796	0.8979

TABLE D-XV

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 10.00

KK	FOS	F"	V"
1	0.9999	1.0001	10.0005
2	7.1414	0.1400	1.4003
3	5.3251	0.1878	1.8779
4	7.9779	0.1253	1.2535
5	7.1926	0.1390	1.3903
6	8.4719	0.1180	1.1805
7	8.1161	0.1232	1.2321
8	8.8120	0.1135	1.1348
9	8.6560	0.1155	1.1553
10	9.0676	0.1103	1.1028
11	9.0090	0.1110	1.1100
12	9.2684	0.1079	1.0789
13	9.2583	0.1080	1.0801
14	9.4308	0.1060	1.0604
15	9.4446	0.1059	1.0588
16	9.5649	0.1045	1.0455
17	9.5899	0.1043	1.0428
18	9.6775	0.1033	1.0333
19	9.7069	0.1030	1.0302
20	9.7733	0.1023	1.0232
21	9.8035	0.1020	1.0200
22	9.8556	0.1015	1.0146
23	9.8849	0.1012	1.0116
24	9.9271	0.1007	1.0073
25	9.9547	0.1005	1.0045
26	9.9899	0.1001	1.0010
27	10.0153	0.0998	0.9985
28	10.0451	0.0996	0.9955
29	10.0686	0.0993	0.9932
30	10.0943	0.0991	0.9907
31	10.1158	0.0989	0.9886
32	10.1384	0.0986	0.9864
33	10.1580	0.0984	0.9844
34	10.1789	0.0983	0.9825
35	10.1960	0.0981	0.9808

TABLE D-XVI

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 20.00

KK	EQS	E"	V"
1	0.9999	1.0001	20.0015
2	14.1774	0.0705	1.4107
3	8.4389	0.1185	2.3700
4	15.7286	0.0636	1.2716
5	12.4738	0.0802	1.6034
6	16.5972	0.0603	1.2050
7	14.6102	0.0684	1.3689
8	17.1729	0.0582	1.1646
9	15.8929	0.0629	1.2584
10	17.5921	0.0568	1.1369
11	16.7377	0.0597	1.1949
12	17.9161	0.0558	1.1163
13	17.3336	0.0577	1.1539
14	18.1769	0.0550	1.1003
15	17.7727	0.0563	1.1253
16	18.3931	0.0544	1.0874
17	18.1111	0.0552	1.1043
18	18.5762	0.0538	1.0766
19	18.3792	0.0544	1.0882
20	18.7339	0.0534	1.0676
21	18.5970	0.0538	1.0754
22	18.8714	0.0530	1.0598
23	18.7775	0.0533	1.0651
24	18.9927	0.0527	1.0530
25	18.9296	0.0528	1.0565
26	19.1006	0.0524	1.0471
27	19.0598	0.0525	1.0493
28	19.1971	0.0521	1.0418
29	19.1725	0.0522	1.0432
30	19.2841	0.0519	1.0371
31	19.2713	0.0519	1.0378
32	19.3630	0.0516	1.0329
33	19.3585	0.0517	1.0331
34	19.4347	0.0515	1.0291
35	19.4363	0.0515	1.0290

TABLE D-XVII

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 50.00

KK	EOS	E "	V "
1	0.0020	1.0001	50.0044
2	35.3602	0.0283	1.4137
3	15.5371	0.0644	3.2181
4	39.1533	0.0255	1.2769
5	25.9236	0.0386	1.9280
6	41.2379	0.0242	1.2125
7	31.9868	0.0313	1.5631
8	42.5861	0.0235	1.1741
9	35.7978	0.0279	1.3967
10	43.5452	0.0230	1.1482
11	38.3703	0.0261	1.3028
12	44.2699	0.0226	1.1294
13	40.3202	0.0249	1.2429
14	44.8411	0.0223	1.1150
15	41.6130	0.0240	1.2015
16	45.3056	0.0221	1.1036
17	42.6836	0.0234	1.1714
18	45.6925	0.0219	1.0943
19	43.5343	0.0230	1.1485
20	46.0212	0.0217	1.0865
21	44.2254	0.0226	1.1306
22	46.3047	0.0216	1.0798
23	44.7971	0.0223	1.1161
24	46.5526	0.0215	1.0741
25	45.2774	0.0221	1.1043
26	46.7717	0.0214	1.0690
27	45.6862	0.0219	1.0944
28	46.2671	0.0213	1.0646
29	46.0383	0.0217	1.0861
30	47.1428	0.0212	1.0606
31	46.3444	0.0216	1.0789
32	47.3020	0.0211	1.0570
33	46.6129	0.0215	1.0727
34	47.4471	0.0211	1.0538
35	46.8503	0.0213	1.0672

TABLE D-XVIII

STATIC STRESS=1.0

ALTERNATING STRESS/STATIC STRESS RATIO= 90.00

KK	EOS	F"	V"
1	0.9999	1.0001	90.0077
2	63.6472	0.0157	1.4140
3	22.9897	0.0435	3.9148
4	70.4459	0.0142	1.2776
5	41.4965	0.0241	2.1689
6	74.1669	0.0135	1.2135
7	52.9253	0.0189	1.7005
8	76.5707	0.0131	1.1754
9	60.3423	0.0166	1.4915
10	78.2741	0.0128	1.1498
11	65.4608	0.0153	1.3749
12	79.5557	0.0126	1.1313
13	69.1761	0.0145	1.3010
14	80.5609	0.0124	1.1172
15	71.9818	0.0139	1.2503
16	81.3743	0.0123	1.1060
17	74.1681	0.0135	1.2135
18	82.0483	0.0122	1.0969
19	75.9154	0.0132	1.1855
20	82.6178	0.0121	1.0894
21	77.3411	0.0129	1.1637
22	83.1064	0.0120	1.0829
23	78.5247	0.0127	1.1461
24	83.5312	0.0120	1.0774
25	79.5221	0.0126	1.1318
26	83.9046	0.0119	1.0726
27	80.3728	0.0124	1.1198
28	84.2359	0.0119	1.0684
29	81.1067	0.0123	1.1096
30	84.5324	0.0118	1.0647
31	81.7455	0.0122	1.1010
32	84.7995	0.0118	1.0613
33	82.3065	0.0121	1.0935
34	85.0416	0.0118	1.0583
35	82.8028	0.0121	1.0869

TABLE D-XIX

TIME IN HOURS = 0.0

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN
500	2000	500.0000	20.5079
750	3000	750.0000	37.5230
1000	4000	1000.0000	57.6046
1250	5000	1250.0000	80.3253
1500	6000	1500.0000	105.3980
1750	7000	1750.0000	132.6122
2000	8000	2000.0000	161.8047
2250	9000	2250.0000	192.8453
2500	10000	2500.0000	225.6250
2750	11000	2750.0000	260.0532
3000	12000	3000.0000	296.0513
3250	13000	3250.0000	333.5513
3500	14000	3500.0000	372.4927
3750	15000	3750.0000	412.8223
4000	16000	4000.0000	454.4919
4250	17000	4250.0000	497.4575
4500	18000	4500.0000	541.6804
4750	19000	4750.0000	587.1245
5000	20000	5000.0000	633.7561
5250	21000	5250.0000	681.5442

TABLE D-XX

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=		0.10	0.50
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	27.6518	29.5714
750.0	75.0	789.7244	47.9497	51.2782
1000.0	100.0	1052.9661	70.8602	75.7791
1250.0	125.0	1316.2075	95.9329	102.5923
1500.0	150.0	1579.4490	122.8750	131.4046
1750.0	175.0	1842.6907	151.4783	161.9935
2000.0	200.0	2105.9321	181.5851	194.1902
2250.0	225.0	2369.1736	213.0716	227.8624
2500.0	250.0	2632.4153	245.8361	262.9011
2750.0	275.0	2895.6567	279.7949	299.2175
3000.0	300.0	3158.8982	314.8774	336.7354
3250.0	325.0	3422.1396	351.0222	375.3892
3500.0	350.0	3685.3813	388.1760	415.1221
3750.0	375.0	3948.6228	426.2913	455.8831
4000.0	400.0	4211.8633	465.3269	497.6287
4250.0	425.0	4475.1055	505.2456	540.3181
4500.0	450.0	4738.3437	546.0127	583.9153
4750.0	475.0	5001.5859	587.5981	628.3875
5000.0	500.0	5264.8281	629.9751	673.7058
5250.0	525.0	5528.0703	673.1162	719.8420

TABLE D-XX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=		1.00		2.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	30.4386	31.3312
750.0	75.0	789.7244	52.7820	54.3299
1000.0	100.0	1052.9661	78.0014	80.2889
1250.0	125.0	1316.2075	105.6009	108.6978
1500.0	150.0	1579.4490	135.2581	139.2248
1750.0	175.0	1842.6907	166.7441	171.6341
2000.0	200.0	2105.9321	199.8851	205.7470
2250.0	225.0	2369.1736	234.5446	241.4230
2500.0	250.0	2632.4153	270.6111	278.5471
2750.0	275.0	2895.6567	307.9924	317.0247
3000.0	300.0	3158.8982	346.6106	356.7754
3250.0	325.0	3422.1396	386.3979	397.7295
3500.0	350.0	3685.3813	427.2961	439.8271
3750.0	375.0	3948.6228	469.2524	483.0139
4000.0	400.0	4211.8633	512.2222	527.2437
4250.0	425.0	4475.1055	556.1636	572.4736
4500.0	450.0	4738.3437	601.0393	618.6655
4750.0	475.0	5001.5859	646.8157	665.7844
5000.0	500.0	5264.8281	693.4631	713.7998
5250.0	525.0	5528.0703	740.9521	762.6814

TABLE D-XX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS= 3.00 5.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	31.8654	32.5515
750.0	75.0	789.7244	55.2563	56.4459
1000.0	100.0	1052.9661	81.6579	83.4160
1250.0	125.0	1316.2075	110.5512	112.9314
1500.0	150.0	1579.4490	141.5987	144.6473
1750.0	175.0	1842.6907	174.5607	178.3190
2000.0	200.0	2105.9321	209.2552	213.7605
2250.0	225.0	2369.1736	245.5396	250.8260
2500.0	250.0	2632.4153	283.2966	289.3960
2750.0	275.0	2895.6567	322.4304	329.3723
3000.0	300.0	3158.8982	362.8589	370.6711
3250.0	325.0	3422.1396	404.5112	413.2205
3500.0	350.0	3685.3813	447.3267	456.9575
3750.0	375.0	3948.6228	491.2498	501.8264
4000.0	400.0	4211.8633	536.2339	547.7791
4250.0	425.0	4475.1055	582.2351	594.7708
4500.0	450.0	4738.3437	629.2146	642.7615
4750.0	475.0	5001.5859	677.1370	691.7156
5000.0	500.0	5264.8281	725.9712	741.6011
5250.0	525.0	5528.0703	775.6863	792.3867

TABLE D-XX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=			7.00	10.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	33.0114	33.5061
750.0	75.0	789.7244	57.2435	58.1013
1000.0	100.0	1052.9661	84.5946	85.8623
1250.0	125.0	1316.2075	114.5270	116.2432
1500.0	150.0	1579.4490	146.6911	148.8893
1750.0	175.0	1842.6907	180.8385	183.5484
2000.0	200.0	2105.9321	216.7807	220.0292
2250.0	225.0	2369.1736	254.3700	258.1816
2500.0	250.0	2632.4153	293.4849	297.8828
2750.0	275.0	2895.6567	334.0259	339.0312
3000.0	300.0	3158.8982	375.9084	381.5415
3250.0	325.0	3422.1396	419.0588	425.3384
3500.0	350.0	3685.3813	463.4141	470.3584
3750.0	375.0	3948.6228	508.9167	516.5430
4000.0	400.0	4211.8633	555.5186	563.8430
4250.0	425.0	4475.1055	603.1743	612.2129
4500.0	450.0	4738.3437	651.8433	661.6111
4750.0	475.0	5001.5859	701.4890	712.0007
5000.0	500.0	5264.8281	752.0793	763.3491
5250.0	525.0	5528.0703	803.5825	815.6240

TABLE D-XX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=		20.00		30.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	34.4887	35.0768
750.0	75.0	789.7244	59.8052	60.8249
1000.0	100.0	1052.9661	88.3803	89.8873
1250.0	125.0	1316.2075	119.6522	121.6924
1500.0	150.0	1579.4490	153.2556	155.8689
1750.0	175.0	1842.6907	188.9312	192.1527
2000.0	200.0	2105.9321	226.4818	230.3437
2250.0	225.0	2369.1736	265.7532	270.2847
2500.0	250.0	2632.4153	306.6187	311.8469
2750.0	275.0	2895.6567	348.9739	354.9246
3000.0	300.0	3158.8982	392.7307	399.4272
3250.0	325.0	3422.1396	437.8120	445.2776
3500.0	350.0	3685.3813	484.1523	492.4077
3750.0	375.0	3948.6228	531.6912	540.7576
4000.0	400.0	4211.8633	580.3787	590.2749
4250.0	425.0	4475.1055	630.1667	640.9121
4500.0	450.0	4738.3437	681.0137	692.6262
4750.0	475.0	5001.5859	732.8811	745.3779
5000.0	500.0	5264.8281	785.7356	799.1335
5250.0	525.0	5528.0703	839.5435	853.8591

TABLE D-XX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=		40.00	50.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	35.5001	35.8320
750.0	75.0	789.7244	61.5590	62.1345
1000.0	100.0	1052.9661	90.9721	91.8225
1250.0	125.0	1316.2075	123.1611	124.3124
1500.0	150.0	1579.4490	157.7500	159.2246
1750.0	175.0	1842.6907	194.4717	196.2896
2000.0	200.0	2105.9321	233.1236	235.3028
2250.0	225.0	2369.1736	273.5466	276.1038
2500.0	250.0	2632.4153	315.6104	318.5608
2750.0	275.0	2895.6567	359.2078	362.5657
3000.0	300.0	3158.8982	404.2478	408.0266
3250.0	325.0	3422.1396	450.6514	454.8640
3500.0	350.0	3685.3813	498.3503	503.0090
3750.0	375.0	3948.6228	547.2834	552.3994
4000.0	400.0	4211.8633	597.3987	602.9832
4250.0	425.0	4475.1055	648.6470	654.7104
4500.0	450.0	4738.3437	700.9851	707.5378
4750.0	475.0	5001.5859	754.3735	761.4253
5000.0	500.0	5264.8281	808.7778	816.3384
5250.0	525.0	5528.0703	864.1638	872.2419

TABLE D-XX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=		60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	36.1055	36.3383
750.0	75.0	789.7244	62.6087	63.0124
1000.0	100.0	1052.9661	92.5233	93.1200
1250.0	125.0	1316.2075	125.2612	126.0689
1500.0	150.0	1579.4490	160.4398	161.4745
1750.0	175.0	1842.6907	197.7878	199.0633
2000.0	200.0	2105.9321	237.0987	238.6277
2250.0	225.0	2369.1736	278.2109	280.0051
2500.0	250.0	2632.4153	320.9922	323.0620
2750.0	275.0	2895.6567	365.3330	367.6890
3000.0	300.0	3158.8982	411.1409	413.7922
3250.0	325.0	3422.1396	458.3357	461.2913
3500.0	350.0	3685.3813	506.8481	510.1167
3750.0	375.0	3948.6228	556.6155	560.2051
4000.0	400.0	4211.8633	607.5852	611.5034
4250.0	425.0	4475.1055	659.7075	663.9617
4500.0	450.0	4738.3437	712.9380	717.5354
4750.0	475.0	5001.5859	767.2366	772.1846
5000.0	500.0	5264.8281	822.5688	827.8733
5250.0	525.0	5528.0703	878.8992	884.5669

TABLE D-XX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=		80.00	90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	36.5412	36.7211
750.0	75.0	789.7244	63.3643	63.6763
1000.0	100.0	1052.9661	93.6400	94.1010
1250.0	125.0	1316.2075	126.7729	127.3971
1500.0	150.0	1579.4490	162.3762	163.1756
1750.0	175.0	1842.6907	200.1748	201.1604
2000.0	200.0	2105.9321	239.9602	241.1417
2250.0	225.0	2369.1736	281.5686	282.9551
2500.0	250.0	2632.4153	324.8660	326.4656
2750.0	275.0	2895.6567	369.7419	371.5625
3000.0	300.0	3158.8982	416.1028	418.1516
3250.0	325.0	3422.1396	463.8672	466.1511
3500.0	350.0	3685.3813	512.9651	515.4907
3750.0	375.0	3948.6228	563.3333	566.1069
4000.0	400.0	4211.8633	614.9180	617.9456
4250.0	425.0	4475.1055	667.6692	670.9565
4500.0	450.0	4738.3437	721.5422	725.0947
4750.0	475.0	5001.5859	776.4963	780.3196
5000.0	500.0	5264.8281	832.4961	836.5950
5250.0	525.0	5528.0703	889.5063	893.8860

TABLE D-XXI

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=			0.10	0.50
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	30.6969	32.8278
750.0	150.0	852.8938	53.2299	56.9250
1000.0	200.0	1137.1917	78.6633	84.1239
1250.0	250.0	1421.4895	106.4969	113.8896
1500.0	300.0	1705.7876	136.4060	145.8749
1750.0	350.0	1990.0854	168.1592	179.8322
2000.0	400.0	2274.3835	201.5815	215.5747
2250.0	450.0	2558.6814	236.5347	252.9542
2500.0	500.0	2842.9792	272.9075	291.8518
2750.0	550.0	3127.2773	310.6062	332.1675
3000.0	600.0	3411.5752	349.5520	373.8169
3250.0	650.0	3695.8730	389.6772	416.7273
3500.0	700.0	3980.1711	430.9221	460.8354
3750.0	750.0	4264.4687	473.2351	506.0857
4000.0	800.0	4548.7656	516.5688	552.4275
4250.0	850.0	4833.0625	560.8828	599.8176
4500.0	900.0	5117.3594	606.1396	648.2158
4750.0	950.0	5401.6602	652.3054	697.5864
5000.0	1000.0	5685.9570	699.3477	747.8943
5250.0	1050.0	5970.2539	747.2395	799.1106

TABLE D-XXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=		1.00	2.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	33.7905	34.7814
750.0	150.0	852.8938	58.5944	60.3127
1000.0	200.0	1137.1917	86.5909	89.1303
1250.0	250.0	1421.4895	117.2296	120.6675
1500.0	300.0	1705.7876	150.1528	154.5563
1750.0	350.0	1990.0854	185.1060	190.5345
2000.0	400.0	2274.3835	221.8967	228.4041
2250.0	450.0	2558.6814	260.3723	268.0081
2500.0	500.0	2842.9792	300.4109	309.2207
2750.0	550.0	3127.2773	341.9087	351.9355
3000.0	600.0	3411.5752	384.7795	396.0637
3250.0	650.0	3695.8730	428.9485	441.5278
3500.0	700.0	3980.1711	474.3501	488.2610
3750.0	750.0	4264.4687	520.9272	536.2041
4000.0	800.0	4548.7656	568.6282	585.3040
4250.0	850.0	4833.0625	617.4080	635.5142
4500.0	900.0	5117.3594	667.2256	686.7927
4750.0	950.0	5401.6602	718.0439	739.1016
5000.0	1000.0	5685.9570	769.8271	792.4033
5250.0	1050.0	5970.2539	822.5454	846.6677

TABLE D-XXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=			3.00	5.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	35.3745	36.1361
750.0	150.0	852.8938	61.3411	62.6618
1000.0	200.0	1137.1917	90.6501	92.6017
1250.0	250.0	1421.4895	122.7250	125.3673
1500.0	300.0	1705.7876	157.1917	160.5760
1750.0	350.0	1990.0854	193.7834	197.9555
2000.0	400.0	2274.3835	232.2987	237.3000
2250.0	450.0	2558.6814	272.5779	278.4465
2500.0	500.0	2842.9792	314.4934	321.2644
2750.0	550.0	3127.2773	357.9365	365.6428
3000.0	600.0	3411.5752	402.8171	411.4897
3250.0	650.0	3695.8730	449.0566	458.7246
3500.0	700.0	3980.1711	496.5864	507.2778
3750.0	750.0	4264.4687	545.3472	557.0884
4000.0	800.0	4548.7656	595.2842	608.1006
4250.0	850.0	4833.0525	646.3506	660.2664
4500.0	900.0	5117.3594	698.5037	713.5422
4750.0	950.0	5401.6602	751.7041	767.8882
5000.0	1000.0	5685.9570	805.9148	823.2661
5250.0	1050.0	5970.2539	861.1045	879.6440

TABLE D-XXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=		7.00	10.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	36.6467	37.1958
750.0	150.0	852.8938	63.5472	64.4994
1000.0	200.0	1137.1917	93.9101	95.3174
1250.0	250.0	1421.4895	127.1386	129.0438
1500.0	300.0	1705.7876	162.8448	165.2850
1750.0	350.0	1990.0854	200.7525	203.7607
2000.0	400.0	2274.3835	240.6529	244.2591
2250.0	450.0	2558.6814	282.3806	286.6121
2500.0	500.0	2842.9792	325.8037	330.6858
2750.0	550.0	3127.2773	370.8091	376.3657
3000.0	600.0	3411.5752	417.3037	423.5569
3250.0	650.0	3695.8730	465.2061	472.1772
3500.0	700.0	3980.1711	514.4453	522.1543
3750.0	750.0	4264.4687	564.9595	573.4255
4000.0	800.0	4548.7656	616.6924	625.9336
4250.0	850.0	4833.0625	669.5955	679.6294
4500.0	900.0	5117.3594	723.6240	734.4675
4750.0	950.0	5401.6602	778.7380	790.4072
5000.0	1000.0	5685.9570	834.8982	847.4092
5250.0	1050.0	5970.2539	892.0725	905.4402

TABLE D-XXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=			20.00	30.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	38.2867	38.9395
750.0	150.0	852.8938	66.3909	67.5230
1000.0	200.0	1137.1917	98.1127	99.7857
1250.0	250.0	1421.4895	132.8282	135.0931
1500.0	300.0	1705.7876	170.1322	173.0332
1750.0	350.0	1990.0854	209.7363	213.3126
2000.0	400.0	2274.3835	251.4223	255.7095
2250.0	450.0	2558.6814	295.0173	300.0479
2500.0	500.0	2842.9792	340.3835	346.1877
2750.0	550.0	3127.2773	387.4031	394.0090
3000.0	600.0	3411.5752	435.9783	443.4126
3250.0	650.0	3695.8730	486.0244	494.3120
3500.0	700.0	3980.1711	537.4673	546.6318
3750.0	750.0	4264.4687	590.2419	600.3064
4000.0	800.0	4548.7656	644.2900	655.2761
4250.0	850.0	4833.0625	699.5603	711.4890
4500.0	900.0	5117.3594	756.0068	768.8979
4750.0	950.0	5401.6602	813.5872	827.4600
5000.0	1000.0	5685.9570	872.2605	887.1340
5250.0	1050.0	5970.2539	931.9937	947.8855

TABLE D-XXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=			40.00	50.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	39.4095	39.7778
750.0	150.0	852.8938	68.3379	68.9767
1000.0	200.0	1137.1917	100.9899	101.9340
1250.0	250.0	1421.4895	136.7235	138.0015
1500.0	300.0	1705.7876	175.1215	176.7585
1750.0	350.0	1990.0854	215.8870	217.9051
2000.0	400.0	2274.3835	258.7954	261.2146
2250.0	450.0	2558.6814	303.6692	306.5078
2500.0	500.0	2842.9792	350.3657	353.6409
2750.0	550.0	3127.2773	398.7639	402.4917
3000.0	600.0	3411.5752	448.7637	452.9587
3250.0	650.0	3695.8730	500.2776	504.9541
3500.0	700.0	3980.1711	553.2290	558.4004
3750.0	750.0	4264.4687	607.5513	613.2307
4000.0	800.0	4548.7656	663.1843	669.3838
4250.0	850.0	4833.0625	720.0757	726.8069
4500.0	900.0	5117.3594	778.1772	785.4517
4750.0	950.0	5401.6602	837.4463	845.2747
5000.0	1000.0	5685.9570	897.8403	906.2334
5250.0	1050.0	5970.2539	959.3250	968.2927

TABLE D-XXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=			60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	40.0815	40.3399
750.0	150.0	852.8938	69.5032	69.9514
1000.0	200.0	1137.1917	102.7120	103.3743
1250.0	250.0	1421.4895	139.0548	139.9515
1500.0	300.0	1705.7876	178.1076	179.2561
1750.0	350.0	1990.0854	219.5682	220.9841
2000.0	400.0	2274.3835	263.2083	264.9055
2250.0	450.0	2558.6814	308.8472	310.8389
2500.0	500.0	2842.9792	356.3398	358.6379
2750.0	550.0	3127.2773	405.5635	408.1790
3000.0	600.0	3411.5752	456.4158	459.3591
3250.0	650.0	3695.8730	508.8081	512.0891
3500.0	700.0	3980.1711	562.6624	566.2908
3750.0	750.0	4264.4687	617.9109	621.8958
4000.0	800.0	4548.7656	674.4927	678.8423
4250.0	850.0	4833.0625	732.3540	737.0769
4500.0	900.0	5117.3594	791.4465	796.5503
4750.0	950.0	5401.6602	851.7258	857.2185
5000.0	1000.0	5685.9570	913.1499	919.0386
5250.0	1050.0	5970.2539	975.6829	981.9749

TABLE D-XXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=			80.00	90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	40.5652	40.7649
750.0	150.0	852.8938	70.3420	70.6883
1000.0	200.0	1137.1917	103.9516	104.4634
1250.0	250.0	1421.4895	140.7330	141.4259
1500.0	300.0	1705.7876	180.2571	181.1446
1750.0	350.0	1990.0854	222.2181	223.3122
2000.0	400.0	2274.3835	266.3848	267.6963
2250.0	450.0	2558.6814	312.5745	314.1135
2500.0	500.0	2842.9792	360.6404	362.4160
2750.0	550.0	3127.2773	410.4583	412.4792
3000.0	600.0	3411.5752	461.9243	464.1987
3250.0	650.0	3695.8730	514.9487	517.4841
3500.0	700.0	3980.1711	569.4529	572.2566
3750.0	750.0	4264.4687	625.3684	628.4475
4000.0	800.0	4548.7656	682.6328	685.9939
4250.0	850.0	4833.0625	741.1926	744.8420
4500.0	900.0	5117.3594	800.9980	804.9421
4750.0	950.0	5401.6602	862.0051	866.2495
5000.0	1000.0	5685.9570	924.1704	928.7207
5250.0	1050.0	5970.2539	987.4583	992.3201

TABLE D-XXII

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS= 0.10 0.50

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	33.9842	36.3433
750.0	225.0	919.2629	58.9302	63.0210
1000.0	300.0	1225.6841	87.0874	93.1328
1250.0	375.0	1532.1050	117.9018	126.0862
1500.0	450.0	1838.5261	151.0139	161.4968
1750.0	525.0	2144.9473	186.1675	199.0907
2000.0	600.0	2451.3682	223.1687	238.6604
2250.0	675.0	2757.7893	261.8652	280.0432
2500.0	750.0	3064.2102	302.1328	323.1060
2750.0	825.0	3370.6313	343.8689	367.7393
3000.0	900.0	3677.0525	386.9861	413.8494
3250.0	975.0	3983.4734	431.4072	461.3542
3500.0	1050.0	4289.8945	477.0693	510.1860
3750.0	1125.0	4596.3125	523.9133	560.2817
4000.0	1200.0	4902.7344	571.8879	611.5867
4250.0	1275.0	5209.1562	620.9487	664.0530
4500.0	1350.0	5515.5781	671.0513	717.6335
4750.0	1425.0	5821.9961	722.1604	772.2905
5000.0	1500.0	6128.4180	774.2405	827.9858
5250.0	1575.0	6434.8398	827.2615	884.6873

TABLE D-XXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=		1.00	2.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	37.4091	38.5061
750.0	225.0	919.2629	64.8692	66.7715
1000.0	300.0	1225.6841	95.8640	98.6753
1250.0	375.0	1532.1050	129.7838	133.5899
1500.0	450.0	1838.5261	166.2328	171.1079
1750.0	525.0	2144.9473	204.9292	210.9391
2000.0	600.0	2451.3682	245.6594	252.8637
2250.0	675.0	2757.7893	288.2559	296.7092
2500.0	750.0	3064.2102	332.5815	342.3350
2750.0	825.0	3370.6313	378.5237	389.6243
3000.0	900.0	3677.0525	425.9861	438.4785
3250.0	975.0	3983.4734	474.8840	488.8105
3500.0	1050.0	4289.8945	525.1479	540.5486
3750.0	1125.0	4596.3125	576.7126	593.6255
4000.0	1200.0	4902.7344	629.5222	647.9836
4250.0	1275.0	5209.1562	683.5271	703.5725
4500.0	1350.0	5515.5781	738.6790	760.3416
4750.0	1425.0	5821.9961	794.9390	818.2515
5000.0	1500.0	6128.4180	852.2676	877.2615
5250.0	1575.0	6434.8398	910.6318	937.3374

TABLE D-XXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=		3.00	5.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	39.1627	40.0059
750.0	225.0	919.2629	67.9101	69.3722
1000.0	300.0	1225.6841	100.3579	102.5186
1250.0	375.0	1532.1050	135.8678	138.7930
1500.0	450.0	1838.5261	174.0255	177.7722
1750.0	525.0	2144.9473	214.5359	219.1548
2000.0	600.0	2451.3682	257.1753	262.7122
2250.0	675.0	2757.7893	301.7686	308.2656
2500.0	750.0	3064.2102	348.1721	355.6682
2750.0	825.0	3370.6313	396.2678	404.7996
3000.0	900.0	3677.0525	445.9553	455.5566
3250.0	975.0	3983.4734	497.1455	507.8489
3500.0	1050.0	4289.8945	549.7656	561.6021
3750.0	1125.0	4596.3125	603.7476	616.7461
4000.0	1200.0	4902.7344	659.0327	673.2217
4250.0	1275.0	5209.1562	715.5693	730.9753
4500.0	1350.0	5515.5781	773.3066	789.9558
4750.0	1425.0	5821.9961	832.2039	850.1211
5000.0	1500.0	6128.4180	892.2200	911.4292
5250.0	1575.0	6434.8398	953.3201	973.8450

TABLE D-XXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS= 7.00 10.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	40.5711	41.1791
750.0	225.0	919.2629	70.3523	71.4066
1000.0	300.0	1225.6841	103.9671	105.5250
1250.0	375.0	1532.1050	140.7540	142.8632
1500.0	450.0	1838.5261	180.2840	182.9855
1750.0	525.0	2144.9473	222.2513	225.5817
2000.0	600.0	2451.3682	266.4241	270.4165
2250.0	675.0	2757.7893	312.6211	317.3057
2500.0	750.0	3064.2102	360.6936	366.0986
2750.0	825.0	3370.6313	410.5190	416.6707
3000.0	900.0	3677.0525	461.9934	468.9163
3250.0	975.0	3983.4734	515.0244	522.7419
3500.0	1050.0	4289.8945	569.5371	578.0715
3750.0	1125.0	4596.3125	625.4602	634.8328
4000.0	1200.0	4902.7344	682.7336	692.9644
4250.0	1275.0	5209.1562	741.3035	752.4119
4500.0	1350.0	5515.5781	801.1172	813.1218
4750.0	1425.0	5821.9961	862.1326	875.0518
5000.0	1500.0	6128.4180	924.3071	938.1577
5250.0	1575.0	6434.8398	987.6047	1002.4038

TABLE D-XXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=			20.00	30.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	42.3867	43.1095
750.0	225.0	919.2629	73.5007	74.7540
1000.0	300.0	1225.6841	108.6197	110.4718
1250.0	375.0	1532.1050	147.0529	149.5604
1500.0	450.0	1838.5261	188.3519	191.5636
1750.0	525.0	2144.9473	232.1972	236.1566
2000.0	600.0	2451.3682	278.3469	283.0930
2250.0	675.0	2757.7893	326.6111	332.1804
2500.0	750.0	3064.2102	376.8350	383.2605
2750.0	825.0	3370.6313	428.8901	436.2034
3000.0	900.0	3677.0525	482.6680	490.8982
3250.0	975.0	3983.4734	538.0723	547.2471
3500.0	1050.0	4289.8945	595.0242	605.1704
3750.0	1125.0	4596.3125	653.4502	664.5925
4000.0	1200.0	4902.7344	713.2866	725.4492
4250.0	1275.0	5209.1562	774.4773	787.6836
4500.0	1350.0	5515.5781	836.9678	851.2395
4750.0	1425.0	5821.9961	900.7139	916.0725
5000.0	1500.0	6128.4180	965.6707	982.1367
5250.0	1575.0	6434.8398	1031.8008	1049.3945

TABLE D-XXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=		40.00	50.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	43.6298	44.0376
750.0	225.0	919.2629	75.6561	76.3634
1000.0	300.0	1225.6841	111.8051	112.8502
1250.0	375.0	1532.1050	151.3653	152.7803
1500.0	450.0	1838.5261	193.8754	195.6878
1750.0	525.0	2144.9473	239.0066	241.2408
2000.0	600.0	2451.3682	286.5095	289.1877
2250.0	675.0	2757.7893	336.1895	339.3320
2500.0	750.0	3064.2102	387.8860	391.5117
2750.0	825.0	3370.6313	441.4675	445.5945
3000.0	900.0	3677.0525	496.8225	501.4668
3250.0	975.0	3983.4734	553.8516	559.0291
3500.0	1050.0	4289.8945	612.4739	618.1992
3750.0	1125.0	4596.3125	672.6130	678.9006
4000.0	1200.0	4902.7344	734.2043	741.0676
4250.0	1275.0	5209.1562	797.1897	804.6416
4500.0	1350.0	5515.5781	861.5125	869.5659
4750.0	1425.0	5821.9961	927.1279	935.7947
5000.0	1500.0	6128.4180	993.9897	1003.2815
5250.0	1575.0	6434.8398	1062.0591	1071.9873

TABLE D-XXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=		60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	44.3737	44.6599
750.0	225.0	919.2629	76.9462	77.4424
1000.0	300.0	1225.6841	113.7115	114.4448
1250.0	375.0	1532.1050	153.9463	154.9391
1500.0	450.0	1838.5261	197.1813	198.4529
1750.0	525.0	2144.9473	243.0820	244.6496
2000.0	600.0	2451.3682	291.3950	293.2742
2250.0	675.0	2757.7893	341.9219	344.1270
2500.0	750.0	3064.2102	394.5000	397.0439
2750.0	825.0	3370.6313	448.9954	451.8909
3000.0	900.0	3677.0525	505.2942	508.5527
3250.0	975.0	3983.4734	563.2957	566.9282
3500.0	1050.0	4289.8945	622.9175	626.9346
3750.0	1125.0	4596.3125	684.0823	688.4937
4000.0	1200.0	4902.7344	746.7236	751.5391
4250.0	1275.0	5209.1562	810.7830	816.0115
4500.0	1350.0	5515.5781	876.2026	881.8530
4750.0	1425.0	5821.9961	942.9368	949.0178
5000.0	1500.0	6128.4180	1010.9387	1017.4580
5250.0	1575.0	6434.8398	1080.1689	1087.1348

TABLE D-XXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=		80.00	90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	44.9092	45.1304
750.0	225.0	919.2629	77.8748	78.2583
1000.0	300.0	1225.6841	115.0839	115.6505
1250.0	375.0	1532.1050	155.8043	156.5714
1500.0	450.0	1838.5261	199.5610	200.5436
1750.0	525.0	2144.9473	246.0157	247.2270
2000.0	600.0	2451.3682	294.9116	296.3638
2250.0	675.0	2757.7893	346.0483	347.7522
2500.0	750.0	3064.2102	399.2610	401.2268
2750.0	825.0	3370.6313	454.4141	456.6516
3000.0	900.0	3677.0525	511.3923	513.9102
3250.0	975.0	3983.4734	570.0937	572.9009
3500.0	1050.0	4289.8945	630.4353	633.5393
3750.0	1125.0	4596.3125	692.3381	695.7471
4000.0	1200.0	4902.7344	755.7356	759.4565
4250.0	1275.0	5209.1562	820.5679	824.6082
4500.0	1350.0	5515.5781	886.7773	891.1436
4750.0	1425.0	5821.9961	954.3169	959.0156
5000.0	1500.0	6128.4180	1023.1394	1028.1770
5250.0	1575.0	6434.8398	1093.2051	1098.5879

TABLE D-XXIII

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS= 0.10 0.50

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	40.9655	43.8092
750.0	375.0	1054.8926	71.0362	75.9673
1000.0	500.0	1406.5237	104.9777	112.2650
1250.0	625.0	1758.1545	142.1222	151.9879
1500.0	750.0	2109.7854	182.0365	194.6729
1750.0	875.0	2461.4163	224.4117	239.9897
2000.0	1000.0	2813.0474	269.0139	287.6882
2250.0	1125.0	3164.6782	315.6597	337.5720
2500.0	1250.0	3516.3091	364.2002	389.4817
2750.0	1375.0	3867.9402	414.5098	443.2839
3000.0	1500.0	4219.5703	466.4832	498.8650
3250.0	1625.0	4571.1992	520.0310	556.1301
3500.0	1750.0	4922.8320	575.0730	614.9927
3750.0	1875.0	5274.4609	631.5400	675.3794
4000.0	2000.0	5626.0937	689.3716	737.2256
4250.0	2125.0	5977.7227	748.5093	800.4685
4500.0	2250.0	6329.3555	808.9043	865.0562
4750.0	2375.0	6680.9844	870.5137	930.9419
5000.0	2500.0	7032.6172	933.2935	998.0798
5250.0	2625.0	7384.2461	997.2051	1066.4280

TABLE D-XXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS= 1.00 2.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	45.0940	46.4164
750.0	375.0	1054.8926	78.1951	80.4883
1000.0	500.0	1406.5237	115.5572	118.9461
1250.0	625.0	1758.1545	156.4451	161.0331
1500.0	750.0	2109.7854	200.3819	206.2583
1750.0	875.0	2461.4163	247.0276	254.2720
2000.0	1000.0	2813.0474	296.1250	304.8091
2250.0	1125.0	3164.6782	347.4717	357.6616
2500.0	1250.0	3516.3091	400.9038	412.6609
2750.0	1375.0	3867.9402	456.2837	469.6648
3000.0	1500.0	4219.5703	513.4949	528.5537
3250.0	1625.0	4571.1992	572.4392	589.2268
3500.0	1750.0	4922.8320	633.0281	651.5925
3750.0	1875.0	5274.4609	695.1858	715.5730
4000.0	2000.0	5626.0937	758.8457	781.0999
4250.0	2125.0	5977.7227	823.9431	848.1062
4500.0	2250.0	6329.3555	890.4248	916.5376
4750.0	2375.0	6680.9844	958.2429	986.3447
5000.0	2500.0	7032.6172	1027.3496	1057.4780
5250.0	2625.0	7384.2461	1097.7021	1129.8938

TABLE D-XXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=			3.00	5.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	47.2079	48.2243
750.0	375.0	1054.8926	81.9608	83.6232
1000.0	500.0	1406.5237	120.9743	123.5789
1250.0	625.0	1758.1545	163.7789	167.3051
1500.0	750.0	2109.7854	209.7753	214.2917
1750.0	875.0	2461.4163	258.6077	264.1753
2000.0	1000.0	2813.0474	310.0066	316.6809
2250.0	1125.0	3164.6782	363.7603	371.5920
2500.0	1250.0	3516.3091	419.6973	428.7332
2750.0	1375.0	3867.9402	477.6731	487.9575
3000.0	1500.0	4219.5703	537.5664	549.1401
3250.0	1625.0	4571.1992	599.2739	612.1760
3500.0	1750.0	4922.8320	662.7029	676.9709
3750.0	1875.0	5274.4609	727.7744	743.4434
4000.0	2000.0	5626.0937	794.4187	811.5225
4250.0	2125.0	5977.7227	862.5676	881.1387
4500.0	2250.0	6329.3555	932.1658	952.2354
4750.0	2375.0	6680.9844	1003.1631	1024.7612
5000.0	2500.0	7032.6172	1075.5095	1098.6650
5250.0	2625.0	7384.2461	1149.1599	1173.9011

TABLE D-XXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=			7.00	10.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	48.9056	49.6385
750.0	375.0	1054.8926	84.8047	86.0755
1000.0	500.0	1406.5237	125.3249	127.2029
1250.0	625.0	1758.1545	169.6690	172.2114
1500.0	750.0	2109.7854	217.3195	220.5760
1750.0	875.0	2461.4163	267.9080	271.9226
2000.0	1000.0	2813.0474	321.1555	325.9680
2250.0	1125.0	3164.6782	376.8423	382.4893
2500.0	1250.0	3516.3091	434.7908	441.3062
2750.0	1375.0	3867.9402	494.8518	502.2671
3000.0	1500.0	4219.5703	556.8989	565.2441
3250.0	1625.0	4571.1992	620.8257	630.1287
3500.0	1750.0	4922.8320	686.5359	696.8237
3750.0	1875.0	5274.4609	753.9478	765.2456
4000.0	2000.0	5626.0937	822.9885	835.3210
4250.0	2125.0	5977.7227	893.5884	906.9788
4500.0	2250.0	6329.3555	965.6897	980.1604
4750.0	2375.0	6680.9844	1039.2402	1054.8132
5000.0	2500.0	7032.6172	1114.1882	1130.8843
5250.0	2625.0	7384.2461	1190.4875	1208.3269

TABLE D-XXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=			20.00	30.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	51.0942	51.9654
750.0	375.0	1054.8926	88.5998	90.1106
1000.0	500.0	1406.5237	130.9333	133.1660
1250.0	625.0	1758.1545	177.2618	180.2844
1500.0	750.0	2109.7854	227.0447	230.9162
1750.0	875.0	2461.4163	279.8972	284.6697
2000.0	1000.0	2813.0474	335.5273	341.2488
2250.0	1125.0	3164.6782	393.7063	400.4197
2500.0	1250.0	3516.3091	454.2480	461.9939
2750.0	1375.0	3867.9402	516.9968	525.8125
3000.0	1500.0	4219.5703	581.8206	591.7417
3250.0	1625.0	4571.1992	648.6082	659.6680
3500.0	1750.0	4922.8320	717.2590	729.4893
3750.0	1875.0	5274.4609	787.6875	801.1187
4000.0	2000.0	5626.0937	859.8179	874.4792
4250.0	2125.0	5977.7227	933.5771	949.4963
4500.0	2250.0	6329.3555	1008.9050	1026.1084
4750.0	2375.0	6680.9844	1085.7471	1104.2607
5000.0	2500.0	7032.6172	1164.0491	1183.8979
5250.0	2625.0	7384.2461	1243.7627	1264.9709

TABLE D-XXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=			40.00	50.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	52.5926	53.0842
750.0	375.0	1054.8926	91.1981	92.0506
1000.0	500.0	1406.5237	134.7731	136.0329
1250.0	625.0	1758.1545	182.4601	184.1658
1500.0	750.0	2109.7854	233.7030	235.8877
1750.0	875.0	2461.4163	288.1052	290.7986
2000.0	1000.0	2813.0474	345.3669	348.5955
2250.0	1125.0	3164.6782	405.2520	409.0403
2500.0	1250.0	3516.3091	467.5693	471.9402
2750.0	1375.0	3867.9402	532.1582	537.1328
3000.0	1500.0	4219.5703	598.8831	604.4812
3250.0	1625.0	4571.1992	667.6292	673.8701
3500.0	1750.0	4922.8320	738.2932	745.1946
3750.0	1875.0	5274.4609	810.7869	818.3662
4000.0	2000.0	5626.0937	885.0327	893.3062
4250.0	2125.0	5977.7227	960.9551	969.9382
4500.0	2250.0	6329.3555	1038.4919	1048.1997
4750.0	2375.0	6680.9844	1117.5874	1128.0347
5000.0	2500.0	7032.6172	1198.1858	1209.3865
5250.0	2625.0	7384.2461	1280.2371	1292.2048

TABLE D-XXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=			60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	53.4894	53.8343
750.0	375.0	1054.8926	82.7531	93.3513
1000.0	500.0	1406.5237	137.0711	137.9551
1250.0	625.0	1758.1545	185.5714	186.7681
1500.0	750.0	2109.7854	237.6880	239.2208
1750.0	875.0	2461.4163	293.0181	294.9075
2000.0	1000.0	2813.0474	351.2561	353.5212
2250.0	1125.0	3164.6782	412.1621	414.8201
2500.0	1250.0	3516.3091	475.5420	478.6089
2750.0	1375.0	3867.9402	541.2324	544.7227
3000.0	1500.0	4219.5703	609.0947	613.0227
3250.0	1625.0	4571.1992	679.0132	683.3921
3500.0	1750.0	4922.8320	750.8821	755.7244
3750.0	1875.0	5274.4609	824.6121	829.9299
4000.0	2000.0	5626.0937	900.1240	905.9287
4250.0	2125.0	5977.7227	977.3408	983.6436
4500.0	2250.0	6329.3555	1056.1997	1063.0110
4750.0	2375.0	6680.9944	1136.6440	1143.9741
5000.0	2500.0	7032.6172	1218.6167	1226.4753
5250.0	2625.0	7384.2461	1302.0671	1310.4639

TABLE D-XXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=	80.00	90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	54.1349	54.4014
750.0	375.0	1054.8926	93.8726	94.3348
1000.0	500.0	1406.5237	138.7254	139.4084
1250.0	625.0	1758.1545	187.8110	188.7357
1500.0	750.0	2109.7854	240.5566	241.7410
1750.0	875.0	2461.4163	296.5542	298.0144
2000.0	1000.0	2813.0474	355.4954	357.2456
2250.0	1125.0	3164.6782	417.1365	419.1904
2500.0	1250.0	3516.3091	481.2812	483.6509
2750.0	1375.0	3867.9402	547.7644	550.4614
3000.0	1500.0	4219.5703	616.4458	619.4810
3250.0	1625.0	4571.1992	687.2080	690.5916
3500.0	1750.0	4922.8320	759.9443	763.6860
3750.0	1875.0	5274.4609	834.5642	838.6733
4000.0	2000.0	5626.0937	910.9873	915.4727
4250.0	2125.0	5977.7227	989.1362	994.0063
4500.0	2250.0	6329.3555	1068.9468	1074.2100
4750.0	2375.0	6680.9844	1150.3618	1156.0259
5000.0	2500.0	7032.6172	1233.3237	1239.3962
5250.0	2625.0	7384.2461	1317.7815	1324.2698

TABLE D-XXIV

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=			0.10	0.50
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	38.5546	41.2310
600.0	480.0	1008.7993	66.8557	71.4966
800.0	640.0	1345.0659	98.7995	105.6579
1000.0	800.0	1681.3325	133.7581	143.0432
1200.0	960.0	2017.5989	171.3231	183.2159
1400.0	1120.0	2353.8655	211.2045	225.8656
1600.0	1280.0	2690.1321	253.1819	270.7568
1800.0	1440.0	3026.3984	297.0828	317.7053
2000.0	1600.0	3362.6650	342.7659	366.5598
2200.0	1760.0	3698.9316	390.1147	417.1953
2400.0	1920.0	4035.1980	439.0298	469.5059
2600.0	2080.0	4371.4609	489.4258	523.4001
2800.0	2240.0	4707.7305	541.2290	578.7996
3000.0	2400.0	5043.9961	594.3733	635.6331
3200.0	2560.0	5380.2617	648.7996	693.8372
3400.0	2720.0	5716.5273	704.4583	753.3594
3600.0	2880.0	6052.7969	761.2998	814.1470
3800.0	3040.0	6389.0625	819.2822	876.1543
4000.0	3200.0	6725.3281	878.3667	939.3403
4200.0	3360.0	7061.5937	938.5166	1003.6655

TABLE D-XXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=			1.00	2.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	42.4401	43.6847
600.0	480.0	1008.7993	73.5933	75.7515
800.0	640.0	1345.0659	108.7564	111.9458
1000.0	800.0	1681.3325	147.2381	151.5560
1200.0	960.0	2017.5989	188.5889	194.1195
1400.0	1120.0	2353.8655	232.4894	239.3074
1600.0	1280.0	2690.1321	278.6973	286.8704
1800.0	1440.0	3026.3984	327.0225	336.6128
2000.0	1600.0	3362.6650	377.3096	388.3745
2200.0	1760.0	3698.9316	429.4302	442.0237
2400.0	1920.0	4035.1980	483.2747	497.4473
2600.0	2080.0	4371.4609	538.7495	554.5491
2800.0	2240.0	4707.7305	595.7734	613.2451
3000.0	2400.0	5043.9961	654.2737	673.4612
3200.0	2560.0	5380.2617	714.1848	735.1292
3400.0	2720.0	5716.5273	775.4526	798.1938
3600.0	2880.0	6052.7969	838.0227	862.5989
3800.0	3040.0	6389.0625	901.8486	928.2966
4000.0	3200.0	6725.3281	966.8875	995.2427
4200.0	3360.0	7061.5937	1033.0991	1063.3960

TABLE D-XXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=			3.00	5.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	44.4296	45.3862
600.0	480.0	1008.7993	77.0432	78.7019
800.0	640.0	1345.0659	113.8546	116.3059
1000.0	800.0	1681.3325	154.1402	157.4589
1200.0	960.0	2017.5989	197.4295	201.6801
1400.0	1120.0	2353.8655	243.3880	248.6281
1600.0	1280.0	2690.1321	291.7620	298.0435
1800.0	1440.0	3026.3984	342.3525	349.7231
2000.0	1600.0	3362.6650	394.9968	403.5012
2200.0	1760.0	3698.9316	449.5608	459.2397
2400.0	1920.0	4035.1980	505.9294	516.8220
2600.0	2080.0	4371.4609	564.0049	576.1477
2800.0	2240.0	4707.7305	623.7019	637.1301
3000.0	2400.0	5043.9961	684.9446	699.6912
3200.0	2560.0	5380.2617	747.6641	763.7612
3400.0	2720.0	5716.5273	811.8040	829.2822
3600.0	2880.0	6052.7969	877.3074	896.1956
3800.0	3040.0	6389.0625	944.1252	964.4521
4000.0	3200.0	6725.3281	1012.2129	1034.0059
4200.0	3360.0	7061.5937	1081.5286	1104.8137

TABLE D-XXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=			7.00	10.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	46.0274	46.7172
600.0	480.0	1008.7993	79.8139	81.0099
800.0	640.0	1345.0659	117.9492	119.7167
1000.0	800.0	1681.3325	159.6836	162.0765
1200.0	960.0	2017.5989	204.5297	207.5946
1400.0	1120.0	2353.8655	252.1410	255.9193
1600.0	1280.0	2690.1321	302.2546	306.7839
1800.0	1440.0	3026.3984	354.6646	359.9792
2000.0	1600.0	3362.6650	409.2024	415.3342
2200.0	1760.0	3698.9316	465.7285	472.7075
2400.0	1920.0	4035.1980	524.1243	531.9783
2600.0	2080.0	4371.4609	584.2883	593.0437
2800.0	2240.0	4707.7305	646.1323	655.8145
3000.0	2400.0	5043.9961	709.5774	720.2104
3200.0	2560.0	5380.2617	774.5525	786.1592
3400.0	2720.0	5716.5273	840.9993	853.6016
3600.0	2880.0	6052.7969	908.8582	922.4773
3800.0	3040.0	6389.0625	978.0791	992.7356
4000.0	3200.0	6725.3281	1048.6155	1064.3289
4200.0	3360.0	7061.5937	1120.4238	1137.2134

TABLE D-XXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS= 20.00 30.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	48.0872	48.9072
600.0	480.0	1008.7993	83.3856	84.8075
800.0	640.0	1345.0659	123.2275	125.3288
1000.0	800.0	1681.3325	166.8296	169.6743
1200.0	960.0	2017.5989	213.6826	217.3262
1400.0	1120.0	2353.8655	263.4243	267.9163
1600.0	1280.0	2690.1321	315.7809	321.1653
1800.0	1440.0	3026.3984	370.5361	376.8542
2000.0	1600.0	3362.6650	427.5144	434.8042
2200.0	1760.0	3698.9316	486.5703	494.8669
2400.0	1920.0	4035.1980	547.5793	556.9165
2600.0	2080.0	4371.4609	610.4355	620.8445
2800.0	2240.0	4707.7305	675.0471	686.5579
3000.0	2400.0	5043.9961	741.3315	753.9724
3200.0	2560.0	5380.2617	809.2144	823.0129
3400.0	2720.0	5716.5273	878.6345	893.6167
3600.0	2880.0	6052.7969	949.5303	965.7212
3800.0	3040.0	6389.0625	1021.8489	1039.2729
4000.0	3200.0	6725.3281	1095.5417	1114.2227
4200.0	3360.0	7061.5937	1170.5637	1190.5237

TABLE D-XXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS= 40.00 50.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	49.4974	49.9601
600.0	480.0	1008.7993	85.8310	86.6333
800.0	640.0	1345.0659	126.8413	128.0270
1000.0	800.0	1681.3325	171.7220	173.3273
1200.0	960.0	2017.5989	219.9490	222.0051
1400.0	1120.0	2353.8655	271.1494	273.6843
1600.0	1280.0	2690.1321	325.0413	328.0798
1800.0	1440.0	3026.3984	381.4023	384.9678
2000.0	1600.0	3362.6650	440.0518	444.1653
2200.0	1760.0	3698.9316	500.8394	505.5212
2400.0	1920.0	4035.1980	563.6375	568.9062
2600.0	2080.0	4371.4609	628.3372	634.2109
2800.0	2240.0	4707.7305	694.8435	701.3389
3000.0	2400.0	5043.9961	763.0718	770.2048
3200.0	2560.0	5380.2617	832.9453	840.7317
3400.0	2720.0	5716.5273	904.4014	912.8555
3600.0	2880.0	6052.7969	977.3760	986.5125
3800.0	3040.0	6389.0625	1051.8154	1061.6477
4000.0	3200.0	6725.3281	1127.6694	1138.2109
4200.0	3360.0	7061.5937	1204.8914	1216.1545

TABLE D-XXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=			60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	50.3414	50.6660
600.0	480.0	1008.7993	87.2945	87.8575
800.0	640.0	1345.0659	129.0041	129.8360
1000.0	800.0	1681.3325	174.6501	175.7764
1200.0	960.0	2017.5989	223.6994	225.1420
1400.0	1120.0	2353.8655	275.7729	277.5515
1600.0	1280.0	2690.1321	330.5837	332.7156
1800.0	1440.0	3026.3984	387.9058	390.4075
2000.0	1600.0	3362.6650	447.5552	450.4414
2200.0	1760.0	3698.9316	509.3794	512.6643
2400.0	1920.0	4035.1980	573.2483	576.9451
2600.0	2080.0	4371.4609	639.0513	643.1724
2800.0	2240.0	4707.7305	706.6917	711.2490
3000.0	2400.0	5043.9961	776.0833	781.0879
3200.0	2560.0	5380.2617	847.1482	852.6113
3400.0	2720.0	5716.5273	919.8228	925.7544
3600.0	2880.0	6052.7969	994.0417	1000.4521
3800.0	3040.0	6389.0625	1069.7505	1076.6492
4000.0	3200.0	6725.3281	1146.8979	1154.2939
4200.0	3360.0	7061.5937	1225.4365	1233.3391

TABLE D-XXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=		80.00	90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	50.9490	51.1998
600.0	480.0	1008.7993	88.3481	88.7831
800.0	640.0	1345.0659	130.5610	131.2039
1000.0	800.0	1681.3325	176.7579	177.6283
1200.0	960.0	2017.5989	226.3992	227.5139
1400.0	1120.0	2353.8655	279.1013	280.4756
1600.0	1280.0	2690.1321	334.5735	336.2207
1800.0	1440.0	3026.3984	392.5874	394.5203
2000.0	1600.0	3362.6650	452.9565	455.1868
2200.0	1760.0	3698.9316	515.5269	518.0652
2400.0	1920.0	4035.1980	580.1667	583.0232
2600.0	2080.0	4371.4609	646.7637	649.9482
2800.0	2240.0	4707.7305	715.2205	718.7419
3000.0	2400.0	5043.9961	785.4495	789.3169
3200.0	2560.0	5380.2617	857.3723	861.5937
3400.0	2720.0	5716.5273	930.9238	935.5073
3600.0	2880.0	6052.7969	1006.0386	1010.9919
3800.0	3040.0	6389.0625	1082.6609	1087.9917
4000.0	3200.0	6725.3281	1160.7395	1166.4546
4200.0	3360.0	7061.5937	1240.2261	1246.3325

TABLE D-XXV

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS= 0.10 0.50

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	44.4018	47.4840
600.0	600.0	1119.3745	76.9949	82.3396
800.0	800.0	1492.4995	113.7833	121.6817
1000.0	1000.0	1865.6243	154.0435	164.7367
1200.0	1200.0	2238.7493	197.3057	211.0021
1400.0	1400.0	2611.8740	243.2354	260.1199
1600.0	1600.0	2984.9990	291.5793	311.8198
1800.0	1800.0	3358.1238	342.1379	365.8879
2000.0	2000.0	3731.2488	394.7495	422.1519
2200.0	2200.0	4104.3711	449.2786	480.4661
2400.0	2400.0	4477.4961	505.6121	540.7102
2600.0	2600.0	4850.6211	563.6511	602.7781
2800.0	2800.0	5223.7461	623.3110	666.5793
3000.0	3000.0	5596.8711	684.5144	732.0312
3200.0	3200.0	5969.9961	747.1963	799.0642
3400.0	3400.0	6343.1211	811.2944	867.6121
3600.0	3600.0	6716.2461	876.7568	937.6184
3800.0	3800.0	7089.3711	943.5332	1009.0303
4000.0	4000.0	7462.4961	1011.5784	1081.7991
4200.0	4200.0	7835.6211	1080.8516	1155.8811

TABLE D-XXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=		1.00	2.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	48.8766	50.3099
600.0	600.0	1119.3745	84.7543	87.2399
800.0	800.0	1492.4995	125.2502	128.9233
1000.0	1000.0	1865.6243	169.5678	174.5406
1200.0	1200.0	2238.7493	217.1899	223.5593
1400.0	1400.0	2611.8740	267.7483	275.6003
1600.0	1600.0	2984.9990	320.9644	330.3770
1800.0	1800.0	3358.1238	376.6182	387.6628
2000.0	2000.0	3731.2488	434.5320	447.2751
2200.0	2200.0	4104.3711	494.5564	509.0598
2400.0	2400.0	4477.4961	556.5671	572.8892
2600.0	2600.0	4850.6211	620.4553	638.6509
2800.0	2800.0	5223.7461	686.1277	706.2493
3000.0	3000.0	5596.8711	753.4990	775.5964
3200.0	3200.0	5969.9961	822.4978	846.6187
3400.0	3400.0	6343.1211	893.0557	919.2456
3600.0	3600.0	6716.2461	965.1152	993.4185
3800.0	3800.0	7089.3711	1038.6213	1069.0803
4000.0	4000.0	7462.4961	1113.5239	1146.1794
4200.0	4200.0	7835.6211	1189.7786	1224.6704

TABLE D-XXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS= 3.00 5.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	51.1678	52.2694
600.0	600.0	1119.3745	88.7274	90.6377
800.0	800.0	1492.4995	131.1217	133.9447
1000.0	1000.0	1865.6243	177.5167	181.3386
1200.0	1200.0	2238.7493	227.3713	232.2666
1400.0	1400.0	2611.8740	280.2996	286.3345
1600.0	1600.0	2984.9990	336.0103	343.2446
1800.0	1800.0	3358.1238	394.2732	402.7617
2000.0	2000.0	3731.2488	454.9019	464.6958
2200.0	2200.0	4104.3711	517.7400	528.8870
2400.0	2400.0	4477.4961	582.6577	595.2021
2600.0	2600.0	4850.6211	649.5408	663.5254
2800.0	2800.0	5223.7461	718.2917	733.7566
3000.0	3000.0	5596.8711	788.8213	805.8044
3200.0	3200.0	5969.9961	861.0547	879.5930
3400.0	3400.0	6343.1211	934.9202	955.0488
3600.0	3600.0	6716.2461	1010.3577	1032.1106
3800.0	3800.0	7089.3711	1087.3096	1110.7192
4000.0	4000.0	7462.4961	1165.7234	1190.8213
4200.0	4200.0	7835.6211	1245.5527	1272.3694

TABLE D-XXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=		7.00	10.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	53.0079	53.8023
600.0	600.0	1119.3745	91.9184	93.2957
800.0	800.0	1492.4995	135.8372	137.8727
1000.0	1000.0	1865.6243	183.9008	186.6566
1200.0	1200.0	2238.7493	235.5483	239.0780
1400.0	1400.0	2611.8740	290.3801	294.7314
1600.0	1600.0	2984.9990	348.0945	353.3105
1800.0	1800.0	3358.1238	408.4524	414.5730
2000.0	2000.0	3731.2488	471.2615	478.3235
2200.0	2200.0	4104.3711	536.3596	544.3970
2400.0	2400.0	4477.4961	603.6121	612.6570
2600.0	2600.0	4850.6211	672.9004	682.9839
2800.0	2800.0	5223.7461	744.1238	755.2747
3000.0	3000.0	5596.8711	817.1899	829.4355
3200.0	3200.0	5969.9961	892.0210	905.3879
3400.0	3400.0	6343.1211	968.5430	983.0564
3600.0	3600.0	6716.2461	1046.6934	1062.3782
3800.0	3800.0	7089.3711	1126.4128	1143.2920
4000.0	4000.0	7462.4961	1207.6467	1225.7432
4200.0	4200.0	7835.6211	1290.3469	1309.6826

TABLE D-XXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=			20.00	30.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	55.3801	56.3244
600.0	600.0	1119.3745	96.0318	97.6693
800.0	800.0	1492.4995	141.9160	144.3359
1000.0	1000.0	1865.6243	192.1305	195.4066
1200.0	1200.0	2238.7493	246.0893	250.2955
1400.0	1400.0	2611.8740	303.3750	308.5479
1600.0	1600.0	2984.9990	363.6719	369.8730
1800.0	1800.0	3358.1238	426.7310	434.0076
2000.0	2000.0	3731.2488	492.3508	500.7463
2200.0	2200.0	4104.3711	560.3621	569.9172
2400.0	2400.0	4477.4961	630.6240	641.3772
2600.0	2600.0	4850.6211	703.0132	715.0007
2800.0	2800.0	5223.7461	777.4241	790.6804
3000.0	3000.0	5596.8711	853.7598	868.3179
3200.0	3200.0	5969.9961	931.9397	947.8306
3400.0	3400.0	6343.1211	1011.8860	1029.1401
3600.0	3600.0	6716.2461	1093.5337	1112.1802
3800.0	3800.0	7089.3711	1176.8206	1196.8872
4000.0	4000.0	7462.4961	1261.6897	1283.2036
4200.0	4200.0	7835.6211	1348.0908	1371.0781

TABLE D-XXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=			40.00	50.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	57.0042	57.5370
600.0	600.0	1119.3745	98.8480	99.7720
800.0	800.0	1492.4995	146.0779	147.4434
1000.0	1000.0	1865.6243	197.7649	199.6136
1200.0	1200.0	2238.7493	253.3061	255.6740
1400.0	1400.0	2611.8740	312.2715	315.1907
1600.0	1600.0	2984.9990	374.3369	377.8362
1800.0	1800.0	3358.1238	439.2454	443.3513
2000.0	2000.0	3731.2488	506.7896	511.5269
2200.0	2200.0	4104.3711	576.7952	582.1870
2400.0	2400.0	4477.4961	649.1177	655.1855
2600.0	2600.0	4850.6211	723.6296	730.3940
2800.0	2800.0	5223.7461	800.2227	807.7031
3000.0	3000.0	5596.8711	878.7971	887.0120
3200.0	3200.0	5969.9961	959.2695	968.2368
3400.0	3400.0	6343.1211	1041.5603	1051.2969
3600.0	3600.0	6716.2461	1125.6025	1136.1248
3800.0	3800.0	7089.3711	1211.3318	1222.6553
4000.0	4000.0	7462.4961	1298.6899	1310.8301
4200.0	4200.0	7835.6211	1387.6248	1400.5962

TABLE D-XXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=			60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	57.9762	58.3500
600.0	600.0	1119.3745	100.5335	101.1818
800.0	800.0	1492.4995	148.5687	149.5268
1000.0	1000.0	1865.6243	201.1371	202.4342
1200.0	1200.0	2238.7493	257.6252	259.2866
1400.0	1400.0	2611.8740	317.5962	319.6445
1600.0	1600.0	2984.9990	380.7200	383.1750
1800.0	1800.0	3358.1238	446.7351	449.6160
2000.0	2000.0	3731.2488	515.4309	518.7549
2200.0	2200.0	4104.3711	586.6304	590.4136
2400.0	2400.0	4477.4961	660.1860	664.4436
2600.0	2600.0	4850.6211	735.9687	740.7148
2800.0	2800.0	5223.7461	813.8677	819.1162
3000.0	3000.0	5596.8711	893.7817	899.5457
3200.0	3200.0	5969.9961	975.6265	981.9182
3400.0	3400.0	6343.1211	1059.3206	1066.1519
3600.0	3600.0	6716.2461	1144.7957	1152.1785
3800.0	3800.0	7089.3711	1231.9868	1239.9316
4000.0	4000.0	7462.4961	1320.8345	1329.3523
4200.0	4200.0	7835.6211	1411.2859	1420.3870

TABLE D-XXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=			80.00	90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	58.6759	58.9648
600.0	600.0	1119.3745	101.7468	102.2478
800.0	800.0	1492.4995	150.3617	151.1021
1000.0	1000.0	1865.6243	203.5646	204.5668
1200.0	1200.0	2238.7493	260.7344	262.0183
1400.0	1400.0	2611.8740	321.4292	323.0120
1600.0	1600.0	2984.9990	385.3147	387.2119
1800.0	1800.0	3358.1238	452.1265	454.3528
2000.0	2000.0	3731.2488	521.6516	524.2200
2200.0	2200.0	4104.3711	593.7104	596.6335
2400.0	2400.0	4477.4961	668.1538	671.4436
2600.0	2600.0	4850.6211	744.8508	748.5183
2800.0	2800.0	5223.7461	823.6899	827.7456
3000.0	3000.0	5596.8711	904.5686	909.0225
3200.0	3200.0	5969.9961	987.4011	992.2627
3400.0	3400.0	6343.1211	1072.1052	1077.3838
3600.0	3600.0	6716.2461	1158.6121	1164.3167
3800.0	3800.0	7089.3711	1246.8555	1252.9946
4000.0	4000.0	7462.4961	1336.7754	1343.3572
4200.0	4200.0	7835.6211	1428.3184	1435.3508

TABLE D-XXVI

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=			0.10	0.50
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	153.7665	164.4405
550.0	1650.0	2049.4683	175.0075	187.1560
600.0	1800.0	2235.7834	196.9510	210.6227
650.0	1950.0	2422.0986	219.5591	234.8002
700.0	2100.0	2608.4141	242.7980	259.6521
750.0	2250.0	2794.7292	266.6384	285.1477
800.0	2400.0	2981.0447	291.0549	311.2590
850.0	2550.0	3167.3599	316.0232	337.9604
900.0	2700.0	3353.6753	341.5227	365.2300
950.0	2850.0	3539.9905	367.5339	393.0471
1000.0	3000.0	3726.3059	394.0400	421.3931
1050.0	3150.0	3912.6211	421.0239	450.2502
1100.0	3300.0	4098.9336	448.4707	479.6023
1150.0	3450.0	4285.2500	476.3684	509.4363
1200.0	3600.0	4471.5664	504.7036	539.7385
1250.0	3750.0	4657.8789	533.4634	570.4949
1300.0	3900.0	4844.1953	562.6379	601.6943
1350.0	4050.0	5030.5117	592.2170	633.3269
1400.0	4200.0	5216.8281	622.1895	665.3801
1450.0	4350.0	5403.1406	652.5486	697.8467

TABLE D-XXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS= 1.00 2.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	169.2629	174.2268
550.0	1650.0	2049.4683	192.6445	198.2941
600.0	1800.0	2235.7834	216.7994	223.1574
650.0	1950.0	2422.0986	241.6859	248.7737
700.0	2100.0	2608.4141	267.2668	275.1047
750.0	2250.0	2794.7292	293.5100	302.1174
800.0	2400.0	2981.0447	320.3872	329.7830
850.0	2550.0	3167.3599	347.8716	358.0732
900.0	2700.0	3353.6753	375.9409	386.9658
950.0	2850.0	3539.9905	404.5737	416.4382
1000.0	3000.0	3726.3059	433.7510	446.4712
1050.0	3150.0	3912.6211	463.4543	477.0457
1100.0	3300.0	4098.9336	493.6672	508.1445
1150.0	3450.0	4285.2500	524.3762	539.7542
1200.0	3600.0	4471.5664	555.5671	571.8599
1250.0	3750.0	4657.8789	587.2253	604.4465
1300.0	3900.0	4844.1953	619.3398	637.5027
1350.0	4050.0	5030.5117	651.8999	671.0176
1400.0	4200.0	5216.8281	684.8931	704.9785
1450.0	4350.0	5403.1406	718.3118	739.3772

TABLE D-XXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=		3.00		5.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1529	177.1976	181.0126
550.0	1650.0	2049.4683	201.6753	206.0173
600.0	1800.0	2235.7834	226.9625	231.8490
650.0	1950.0	2422.0986	253.0156	258.4629
700.0	2100.0	2608.4141	279.7957	285.8196
750.0	2250.0	2794.7292	307.2690	313.8845
800.0	2400.0	2981.0447	335.4062	342.6274
850.0	2550.0	3167.3599	364.1790	372.0198
900.0	2700.0	3353.6753	393.5642	402.0376
950.0	2850.0	3539.9905	423.5391	432.6580
1000.0	3000.0	3726.3059	454.0842	463.8606
1050.0	3150.0	3912.6211	485.1799	495.6257
1100.0	3300.0	4098.9336	516.8091	527.9360
1150.0	3450.0	4285.2500	548.9578	560.7766
1200.0	3600.0	4471.5664	581.6108	594.1328
1250.0	3750.0	4657.8789	614.7532	627.9885
1300.0	3900.0	4844.1953	648.3730	662.3325
1350.0	4050.0	5030.5117	682.4595	697.1528
1400.0	4200.0	5216.8281	716.9993	732.4363
1450.0	4350.0	5403.1406	751.9846	768.1748

TABLE D-XXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=		7.00	10.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	183.5702	186.3210
550.0	1650.0	2049.4683	208.9282	212.0590
600.0	1800.0	2235.7834	235.1248	238.6481
650.0	1950.0	2422.0986	262.1147	266.0425
700.0	2100.0	2608.4141	289.8579	294.2014
750.0	2250.0	2794.7292	318.3193	323.0894
800.0	2400.0	2981.0447	347.4685	352.6753
850.0	2550.0	3167.3599	377.2761	382.9294
900.0	2700.0	3353.6753	407.7180	413.8276
950.0	2850.0	3539.9905	438.7710	445.3459
1000.0	3000.0	3726.3059	470.4146	477.4636
1050.0	3150.0	3912.6211	502.6287	510.1604
1100.0	3300.0	4098.9336	535.3953	543.4182
1150.0	3450.0	4285.2500	568.7000	577.2219
1200.0	3600.0	4471.5664	602.5273	611.5564
1250.0	3750.0	4657.8789	636.8616	646.4050
1300.0	3900.0	4844.1953	671.6907	681.7559
1350.0	4050.0	5030.5117	707.0029	717.5974
1400.0	4200.0	5216.8281	742.7849	753.9155
1450.0	4350.0	5403.1406	779.0283	790.7021

TABLE D-XXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=		20.00	30.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	191.7851	195.0553
550.0	1650.0	2049.4683	218.2779	221.9999
600.0	1800.0	2235.7834	245.6469	249.8355
650.0	1950.0	2422.0986	273.8447	278.5142
700.0	2100.0	2608.4141	302.8293	307.9932
750.0	2250.0	2794.7292	332.5645	338.2351
800.0	2400.0	2981.0447	363.0181	369.2080
850.0	2550.0	3167.3599	394.1594	400.8804
900.0	2700.0	3353.6753	425.9636	433.2271
950.0	2850.0	3539.9905	458.4065	466.2229
1000.0	3000.0	3726.3059	491.4661	499.8462
1050.0	3150.0	3912.6211	525.1216	534.0759
1100.0	3300.0	4098.9336	559.3547	568.8926
1150.0	3450.0	4285.2500	594.1499	604.2810
1200.0	3600.0	4471.5664	629.4910	640.2249
1250.0	3750.0	4657.8789	665.3616	676.7073
1300.0	3900.0	4844.1953	701.7493	713.7153
1350.0	4050.0	5030.5117	738.6418	751.2368
1400.0	4200.0	5216.8281	776.0251	789.2576
1450.0	4350.0	5403.1406	813.8906	827.7686

TABLE D-XXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=	40.00	50.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	197.4094	199.2547
550.0	1650.0	2049.4683	224.6791	226.7794
600.0	1800.0	2235.7834	252.8506	255.2143
650.0	1950.0	2422.0986	281.8755	284.5103
700.0	2100.0	2608.4141	311.7102	314.6240
750.0	2250.0	2794.7292	342.3171	345.5171
800.0	2400.0	2981.0447	373.6638	377.1567
850.0	2550.0	3167.3599	405.7185	409.5110
900.0	2700.0	3353.6753	438.4553	442.5540
950.0	2850.0	3539.9905	471.8496	476.2603
1000.0	3000.0	3726.3059	505.8787	510.6074
1050.0	3150.0	3912.6211	540.5212	545.5740
1100.0	3300.0	4098.9336	575.7583	581.1404
1150.0	3450.0	4285.2500	611.5737	617.2908
1200.0	3600.0	4471.5664	647.9514	654.0083
1250.0	3750.0	4657.8789	684.8740	691.2761
1300.0	3900.0	4844.1953	722.3289	729.0811
1350.0	4050.0	5030.5117	760.3032	767.4104
1400.0	4200.0	5216.8281	798.7827	806.2498
1450.0	4350.0	5403.1406	837.7585	845.5898

TABLE D-XXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=			60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	200.7755	202.0703
550.0	1650.0	2049.4683	228.5102	229.9838
600.0	1800.0	2235.7834	257.1621	258.8203
650.0	1950.0	2422.0986	286.6819	288.5305
700.0	2100.0	2608.4141	317.0251	319.0696
750.0	2250.0	2794.7292	348.1543	350.3994
800.0	2400.0	2981.0447	380.0354	382.4861
850.0	2550.0	3167.3599	412.6365	415.2976
900.0	2700.0	3353.6753	445.9316	448.8074
950.0	2850.0	3539.9905	479.8953	482.9900
1000.0	3000.0	3726.3059	514.5046	517.8225
1050.0	3150.0	3912.6211	549.7380	553.2832
1100.0	3300.0	4098.9336	585.5757	589.3521
1150.0	3450.0	4285.2500	622.0020	626.0132
1200.0	3600.0	4471.5664	659.0000	663.2498
1250.0	3750.0	4657.8789	696.5520	701.0439
1300.0	3900.0	4844.1953	734.6455	739.3831
1350.0	4050.0	5030.5117	773.2676	778.2542
1400.0	4200.0	5216.8281	812.4031	817.6421
1450.0	4350.0	5403.1406	852.0437	857.5383

TABLE D-XXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=			80.00	90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	203.1986	204.1991
550.0	1650.0	2049.4683	231.2680	232.4067
600.0	1800.0	2235.7834	260.2656	261.5471
650.0	1950.0	2422.0986	290.1416	291.5703
700.0	2100.0	2608.4141	320.8513	322.4312
750.0	2250.0	2794.7292	352.3560	354.0908
800.0	2400.0	2981.0447	384.6218	386.5156
850.0	2550.0	3167.3599	417.6165	419.6729
900.0	2700.0	3353.6753	451.3135	453.5356
950.0	2850.0	3539.9905	485.6870	488.0784
1000.0	3000.0	3726.3059	520.7141	523.2778
1050.0	3150.0	3912.6211	556.3726	559.1121
1100.0	3300.0	4098.9336	592.6428	595.5610
1150.0	3450.0	4285.2500	629.5088	632.6084
1200.0	3600.0	4471.5664	666.9531	670.2371
1250.0	3750.0	4657.8789	704.9585	708.4297
1300.0	3900.0	4844.1953	743.5117	747.1726
1350.0	4050.0	5030.5117	782.5999	786.4531
1400.0	4200.0	5216.8281	822.2078	826.2561
1450.0	4350.0	5403.1406	862.3267	866.5725

TABLE D-XXVII

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		0.10	0.50
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	267.5276	286.0986
550.0	2750.0	3081.7488	304.4829	325.6191
600.0	3000.0	3361.9080	342.6614	366.4478
650.0	3250.0	3642.0669	381.9956	408.5125
700.0	3500.0	3922.2258	422.4277	451.7512
750.0	3750.0	4202.3828	463.9058	496.1086
800.0	4000.0	4482.5430	506.3860	541.5376
850.0	4250.0	4762.6992	549.8262	587.9934
900.0	4500.0	5042.8594	594.1917	635.4385
950.0	4750.0	5323.0195	639.4465	683.8350
1000.0	5000.0	5603.1797	685.5625	733.1521
1050.0	5250.0	5883.3359	732.5093	783.3577
1100.0	5500.0	6163.4961	780.2629	834.4265
1150.0	5750.0	6443.6562	828.8005	886.3335
1200.0	6000.0	6723.8125	878.0979	939.0527
1250.0	6250.0	7003.9727	928.1357	992.5640
1300.0	6500.0	7284.1328	978.8953	1046.8472
1350.0	6750.0	7564.2891	1030.3560	1101.8801
1400.0	7000.0	7844.4492	1082.5054	1157.6494
1450.0	7250.0	8124.6094	1135.3237	1214.1345

TABLE D-XXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		1.00	2.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	294.4888	303.1250
550.0	2750.0	3081.7488	335.1685	344.9976
600.0	3000.0	3361.9080	377.1043	388.2559
650.0	3250.0	3642.0669	420.4927	432.8242
700.0	3500.0	3922.2258	464.9995	478.6362
750.0	3750.0	4202.3848	510.6577	525.6333
800.0	4000.0	4482.5430	557.4189	573.7659
850.0	4250.0	4762.6992	605.2371	622.9863
900.0	4500.0	5042.8594	654.0735	673.2551
950.0	4750.0	5323.0195	703.9892	724.5315
1000.0	5000.0	5603.1797	754.6526	776.7837
1050.0	5250.0	5883.3359	806.3306	829.9773
1100.0	5500.0	6163.4961	858.8970	884.0852
1150.0	5750.0	6443.6562	912.3262	939.0813
1200.0	6000.0	6723.8125	966.5916	994.9382
1250.0	6250.0	7003.9727	1021.6721	1051.6340
1300.0	6500.0	7284.1328	1077.5471	1109.1477
1350.0	6750.0	7564.2891	1134.1941	1167.4558
1400.0	7000.0	7844.4492	1191.5989	1226.5442
1450.0	7250.0	8124.6094	1249.7402	1286.3906

TABLE D-XXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		3.00	5.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	308.2937	314.9312
550.0	2750.0	3081.7488	350.8804	358.4348
600.0	3000.0	3361.9080	394.8762	403.3779
650.0	3250.0	3642.0669	440.2043	449.6819
700.0	3500.0	3922.2258	486.7976	497.2783
750.0	3750.0	4202.3828	534.5962	546.1060
800.0	4000.0	4482.5430	583.5493	596.1133
850.0	4250.0	4762.6992	633.6091	647.2507
900.0	4500.0	5042.8594	684.7349	699.4773
950.0	4750.0	5323.0195	736.8857	752.7510
1000.0	5000.0	5603.1797	790.0291	807.0381
1050.0	5250.0	5883.3359	844.1294	862.3035
1100.0	5500.0	6163.4961	899.1602	918.5188
1150.0	5750.0	6443.6562	955.0940	975.6570
1200.0	6000.0	6723.8125	1011.9031	1033.6892
1250.0	6250.0	7003.9727	1069.5659	1092.5935
1300.0	6500.0	7284.1328	1128.0601	1152.3472
1350.0	6750.0	7564.2891	1187.3625	1212.9263
1400.0	7000.0	7844.4492	1247.4583	1274.3159
1450.0	7250.0	8124.6094	1308.3252	1336.4934

TABLE D-XXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		7.00	10.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	319.3809	324.1667
550.0	2750.0	3081.7488	363.4990	368.9460
600.0	3000.0	3361.9080	409.0774	415.2073
650.0	3250.0	3642.0669	456.0356	462.8691
700.0	3500.0	3922.2258	504.3044	511.8613
750.0	3750.0	4202.3848	553.8220	562.1208
800.0	4000.0	4482.5430	604.5359	613.5947
850.0	4250.0	4762.6992	656.3958	666.2319
900.0	4500.0	5042.8594	709.3604	719.9900
950.0	4750.0	5323.0195	763.3867	774.8259
1000.0	5000.0	5603.1797	818.4409	830.7053
1050.0	5250.0	5883.3359	874.4871	887.5913
1100.0	5500.0	6163.4961	931.4968	945.4553
1150.0	5750.0	6443.6562	989.4421	1004.2690
1200.0	6000.0	6723.8125	1048.2944	1064.0032
1250.0	6250.0	7003.9727	1108.0310	1124.6348
1300.0	6500.0	7284.1328	1168.6289	1186.1406
1350.0	6750.0	7564.2891	1230.0640	1248.4963
1400.0	7000.0	7844.4492	1292.3210	1311.6863
1450.0	7250.0	8124.6094	1355.3770	1375.6873

TABLE D-XXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		20.00	30.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	333.6733	339.3630
550.0	2750.0	3081.7488	379.7661	386.2417
600.0	3000.0	3361.9080	427.3838	434.6714
650.0	3250.0	3642.0669	476.4436	484.5676
700.0	3500.0	3922.2258	526.8723	535.8564
750.0	3750.0	4202.3828	578.6060	588.4722
800.0	4000.0	4482.5430	631.5894	642.3589
850.0	4250.0	4762.6992	685.7700	697.4636
900.0	4500.0	5042.8594	741.1047	753.7417
950.0	4750.0	5323.0195	797.5488	811.1484
1000.0	5000.0	5603.1797	855.0669	869.6472
1050.0	5250.0	5883.3359	913.6211	929.2000
1100.0	5500.0	6163.4961	973.1821	989.7764
1150.0	5750.0	6443.6562	1033.7207	1051.3472
1200.0	6000.0	6723.8125	1095.2065	1113.8816
1250.0	6250.0	7003.9727	1157.6162	1177.3555
1300.0	6500.0	7284.1328	1220.9260	1241.7446
1350.0	6750.0	7564.2891	1285.1104	1307.0234
1400.0	7000.0	7844.4492	1350.1536	1373.1758
1450.0	7250.0	8124.6094	1416.0310	1440.1768

TABLE D-XXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		40.00	50.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5899	343.4587	346.6694
550.0	2750.0	3081.7488	390.9028	394.5571
600.0	3000.0	3361.9080	439.9172	444.0295
650.0	3250.0	3642.0669	490.4155	495.0000
700.0	3500.0	3922.2258	542.3235	547.3931
750.0	3750.0	4202.3828	595.5740	601.1414
800.0	4000.0	4482.5430	650.1111	656.1882
850.0	4250.0	4762.6992	705.8809	712.4792
900.0	4500.0	5042.8594	762.8381	769.9692
950.0	4750.0	5323.0195	820.9377	828.6118
1000.0	5000.0	5603.1797	880.1423	888.3699
1050.0	5250.0	5883.3359	940.4138	949.2048
1100.0	5500.0	6163.4961	1001.7214	1011.0854
1150.0	5750.0	6443.6562	1064.0354	1073.9819
1200.0	6000.0	6723.8125	1127.3245	1137.8625
1250.0	6250.0	7003.9727	1191.5642	1202.7029
1300.0	6500.0	7284.1328	1256.7305	1268.4785
1350.0	6750.0	7564.2891	1322.7974	1335.1626
1400.0	7000.0	7844.4492	1389.7478	1402.7390
1450.0	7250.0	8124.6094	1457.5574	1471.1826

TABLE D-XXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	349.3152	351.5679
550.0	2750.0	3081.7488	397.5684	400.1323
600.0	3000.0	3361.9080	447.4185	450.3037
650.0	3250.0	3642.0669	498.7778	501.9944
700.0	3500.0	3922.2258	551.5708	555.1279
750.0	3750.0	4202.3828	605.7295	609.6357
800.0	4000.0	4482.5430	661.1965	665.4604
850.0	4250.0	4762.6992	717.9172	722.5469
900.0	4500.0	5042.8594	775.8457	780.8491
950.0	4750.0	5323.0195	834.9358	840.3203
1000.0	5000.0	5603.1797	895.1501	900.9229
1050.0	5250.0	5883.3359	956.4492	962.6172
1100.0	5500.0	6163.4961	1018.8022	1025.3723
1150.0	5750.0	6443.6562	1082.1787	1089.1575
1200.0	6000.0	6723.8125	1146.5469	1153.9409
1250.0	6250.0	7003.9727	1211.8821	1219.6973
1300.0	6500.0	7284.1328	1278.1597	1286.4023
1350.0	6750.0	7564.2891	1345.3530	1354.0288
1400.0	7000.0	7844.4492	1413.4451	1422.5601
1450.0	7250.0	8124.6094	1482.4109	1491.9707

TABLE D-XXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		80.00	90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	353.5310	355.2717
550.0	2750.0	3081.7488	402.3667	404.3477
600.0	3000.0	3361.9080	452.8184	455.0479
650.0	3250.0	3642.0669	504.7976	507.2830
700.0	3500.0	3922.2258	558.2275	560.9761
750.0	3750.0	4202.3828	613.0398	616.0583
800.0	4000.0	4482.5430	669.1763	672.4712
850.0	4250.0	4762.6992	726.5815	730.1589
900.0	4500.0	5042.8594	785.2092	789.0754
950.0	4750.0	5323.0195	845.0125	849.1731
1000.0	5000.0	5603.1797	905.9534	910.4141
1050.0	5250.0	5883.3359	967.9924	972.7585
1100.0	5500.0	6163.4961	1031.0979	1036.1748
1150.0	5750.0	6443.6562	1095.2393	1100.6318
1200.0	6000.0	6723.8125	1160.3843	1166.0977
1250.0	6250.0	7003.9727	1226.5081	1232.5469
1300.0	6500.0	7284.1328	1293.5854	1299.9546
1350.0	6750.0	7564.2891	1361.5896	1368.2937
1400.0	7000.0	7844.4492	1430.5037	1437.5469
1450.0	7250.0	8124.6094	1500.3018	1507.6887

TABLE D-XXVIII

ALTERNATING STRESS / STATIC STRESS =A= 10.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN (TIME IN HOURS= 0.10)	DYNAMIC STRAIN MICROIN/IN (TIME IN HOURS= 0.50)
50.0	500.0	516.6389	26.9523	28.8232
75.0	750.0	774.9585	46.7366	49.9810
100.0	1000.0	1033.2781	69.0676	73.8620
125.0	1250.0	1291.5974	93.5059	99.9968
150.0	1500.0	1549.9170	119.7665	128.0803
175.0	1750.0	1808.2366	147.6463	157.8954
200.0	2000.0	2066.5562	176.9914	189.2776
225.0	2250.0	2324.8755	207.6809	222.0975
250.0	2500.0	2583.1951	239.6164	256.2498
275.0	2750.0	2841.5146	272.7168	291.6479
300.0	3000.0	3099.8342	306.9116	328.2163
325.0	3250.0	3358.1536	342.1421	365.8926
350.0	3500.0	3616.4731	378.3552	404.6196
375.0	3750.0	3874.7927	415.5073	444.3503
400.0	4000.0	4133.1094	453.5542	485.0386
425.0	4250.0	4391.4297	492.4634	526.6487
450.0	4500.0	4649.7500	532.1990	569.1426
475.0	4750.0	4908.0703	572.7334	612.4910
500.0	5000.0	5166.3867	614.0369	656.6614
525.0	5250.0	5424.7070	656.0869	701.6304

TABLE D-XXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS= 1.00 2.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	29.6685	30.5385
75.0	750.0	774.9585	51.4467	52.9555
100.0	1000.0	1033.2781	76.0281	78.2577
125.0	1250.0	1291.5974	102.9293	105.9478
150.0	1500.0	1549.9170	131.8364	135.7027
175.0	1750.0	1808.2366	162.5258	167.2921
200.0	2000.0	2066.5562	194.8284	200.5420
225.0	2250.0	2324.8755	228.6107	235.3151
250.0	2500.0	2583.1951	263.7646	271.4998
275.0	2750.0	2841.5146	300.2009	309.0046
300.0	3000.0	3099.8342	337.8418	347.7493
325.0	3250.0	3358.1536	376.6228	387.6677
350.0	3500.0	3616.4731	416.4856	428.6995
375.0	3750.0	3874.7927	457.3816	470.7949
400.0	4000.0	4133.1094	499.2629	513.9045
425.0	4250.0	4391.4297	542.0933	557.9907
450.0	4500.0	4649.7500	585.8335	603.0137
475.0	4750.0	4908.0703	630.4529	648.9417
500.0	5000.0	5166.3867	675.9187	695.7410
525.0	5250.0	5424.7070	722.2065	743.3862

TABLE D-XXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS=			3.00	5.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	31.0593	31.7280
75.0	750.0	774.9585	53.8584	55.0180
100.0	1000.0	1033.2781	79.5921	81.3057
125.0	1250.0	1291.5974	107.7544	110.0743
150.0	1500.0	1549.9170	138.0166	140.9381
175.0	1750.0	1808.2366	170.1447	173.8079
200.0	2000.0	2066.5562	203.9615	208.3528
225.0	2250.0	2324.8755	239.3275	244.4802
250.0	2500.0	2583.1951	276.1292	282.0742
275.0	2750.0	2841.5146	314.2737	321.0398
300.0	3000.0	3099.8342	353.6790	361.2937
325.0	3250.0	3358.1536	394.2778	402.7666
350.0	3500.0	3616.4731	436.0095	445.3967
375.0	3750.0	3874.7927	478.8225	489.1316
400.0	4000.0	4133.1094	522.6672	533.9202
425.0	4250.0	4391.4297	567.5054	579.7236
450.0	4500.0	4649.7500	613.2959	626.5002
475.0	4750.0	4908.0703	660.0071	674.2168
500.0	5000.0	5166.3867	707.6042	722.8389
525.0	5250.0	5424.7070	756.0620	772.3398

TABLE D-XXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS=			7.00	10.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	32.1763	32.6584
75.0	750.0	774.9585	55.7953	56.6314
100.0	1000.0	1033.2781	82.4545	83.6901
125.0	1250.0	1291.5974	111.6296	113.3024
150.0	1500.0	1549.9170	142.9801	145.1227
175.0	1750.0	1808.2366	176.2637	178.9050
200.0	2000.0	2066.5562	211.2966	214.4629
225.0	2250.0	2324.8755	247.9345	251.6498
250.0	2500.0	2583.1951	286.0598	290.3464
275.0	2750.0	2841.5146	325.5759	330.4546
300.0	3000.0	3099.8342	366.3984	371.8889
325.0	3250.0	3358.1536	408.4575	414.5781
350.0	3500.0	3616.4731	451.6897	458.4583
375.0	3750.0	3874.7927	496.0425	503.4758
400.0	4000.0	4133.1094	541.4641	549.5779
425.0	4250.0	4391.4297	587.9146	596.7246
450.0	4500.0	4649.7500	635.3521	644.8728
475.0	4750.0	4908.0703	683.7432	693.9890
500.0	5000.0	5166.3867	733.0520	744.0366
525.0	5250.0	5424.7070	783.2524	794.9893

TABLE D-XXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS=		20.00	30.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.5389	33.6162	34.1894
75.0	750.0	774.9585	58.2922	59.2862
100.0	1000.0	1033.2781	86.1444	87.6133
125.0	1250.0	1291.5974	116.6251	118.6137
150.0	1500.0	1549.9170	149.3786	151.9258
175.0	1750.0	1808.2366	184.1516	187.2917
200.0	2000.0	2066.5562	220.7523	224.5165
225.0	2250.0	2324.8755	259.0295	263.4465
250.0	2500.0	2583.1951	298.8611	303.9573
275.0	2750.0	2841.5146	340.1458	345.9458
300.0	3000.0	3099.8342	382.7952	389.3223
325.0	3250.0	3358.1536	426.7363	434.0129
350.0	3500.0	3616.4731	471.9033	479.9500
375.0	3750.0	3874.7927	518.2410	527.0776
400.0	4000.0	4133.1094	565.6951	575.3411
425.0	4250.0	4391.4297	614.2244	624.6978
450.0	4500.0	4649.7500	663.7847	675.1033
475.0	4750.0	4908.0703	714.3411	726.5217
500.0	5000.0	5166.3867	765.8567	778.9158
525.0	5250.0	5424.7070	818.3035	832.2568

TABLE D-XXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS=			40.00	50.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	34.6020	34.9255
75.0	750.0	774.9585	60.0017	60.5626
100.0	1000.0	1033.2781	88.6707	89.4996
125.0	1250.0	1291.5974	120.0452	121.1674
150.0	1500.0	1549.9170	153.7593	155.1966
175.0	1750.0	1808.2366	189.5520	191.3239
200.0	2000.0	2066.5562	227.2261	229.3502
225.0	2250.0	2324.8755	266.6260	269.1184
250.0	2500.0	2583.1951	307.6255	310.5012
275.0	2750.0	2841.5146	350.1208	353.3936
300.0	3000.0	3099.8342	394.0208	397.7041
325.0	3250.0	3358.1536	439.2507	443.3567
350.0	3500.0	3616.4731	485.7422	490.2830
375.0	3750.0	3874.7927	533.4387	538.4253
400.0	4000.0	4133.1094	582.2844	587.7275
425.0	4250.0	4391.4297	632.2371	638.1470
450.0	4500.0	4649.7500	683.2507	689.6377
475.0	4750.0	4908.0703	735.2898	742.1631
500.0	5000.0	5166.3867	788.3159	795.6851
525.0	5250.0	5424.7070	842.3010	850.1748

TABLE D-XXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS=			60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	35.1920	35.4190
75.0	750.0	774.9585	61.0248	61.4184
100.0	1000.0	1033.2781	90.1826	90.7642
125.0	1250.0	1291.5974	122.0922	122.8795
150.0	1500.0	1549.9170	156.3811	157.3896
175.0	1750.0	1808.2366	192.7841	194.0274
200.0	2000.0	2066.5562	231.1006	232.5909
225.0	2250.0	2324.8755	271.1724	272.9211
250.0	2500.0	2583.1951	312.8711	314.8887
275.0	2750.0	2841.5146	356.0908	358.3872
300.0	3000.0	3099.8342	400.7305	403.3237
325.0	3250.0	3358.1536	446.7405	449.6216
350.0	3500.0	3616.4731	494.0249	497.2107
375.0	3750.0	3874.7927	542.5347	546.0334
400.0	4000.0	4133.1094	592.2134	596.0322
425.0	4250.0	4391.4297	643.0176	647.1643
450.0	4500.0	4649.7500	694.9011	699.3823
475.0	4750.0	4908.0703	747.8276	752.6501
500.0	5000.0	5166.3867	801.7581	806.9285
525.0	5250.0	5424.7070	856.6636	862.1880

TABLE D-XXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS=		80.00		90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	35.6167	35.7921
75.0	750.0	774.9585	61.7613	62.0654
100.0	1000.0	1033.2781	91.2710	91.7204
125.0	1250.0	1291.5974	123.5657	124.1741
150.0	1500.0	1549.9170	158.2684	159.0477
175.0	1750.0	1808.2366	195.1108	196.0715
200.0	2000.0	2066.5562	233.8897	235.0413
225.0	2250.0	2324.8755	274.4451	275.7964
250.0	2500.0	2583.1951	316.6470	318.2061
275.0	2750.0	2841.5146	360.3884	362.1628
300.0	3000.0	3099.8342	405.5759	407.5728
325.0	3250.0	3358.1536	452.1321	454.3584
350.0	3500.0	3616.4731	499.9871	502.4490
375.0	3750.0	3874.7927	549.0823	551.7859
400.0	4000.0	4133.1094	599.3606	602.3115
425.0	4250.0	4391.4297	650.7778	653.9822
450.0	4500.0	4649.7500	703.2876	706.7505
475.0	4750.0	4908.0703	756.8528	760.5793
500.0	5000.0	5166.3867	811.4341	815.4294
525.0	5250.0	5424.7070	867.0022	871.2712

TABLE D-XXIX

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS=		0.10	0.50
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	219.6567	234.9045
55.0	2750.0	2665.1794	249.9993	267.3533
60.0	3000.0	2907.4685	281.3457	300.8757
65.0	3250.0	3149.7576	313.6414	335.4133
70.0	3500.0	3392.0466	346.8379	370.9146
75.0	3750.0	3634.3357	380.8953	407.3359
80.0	4000.0	3876.6248	415.7737	444.6353
85.0	4250.0	4118.9102	451.4407	482.7783
90.0	4500.0	4361.1992	487.8669	521.7332
95.0	4750.0	4603.4883	525.0239	561.4695
100.0	5000.0	4845.7773	562.8877	601.9617
105.0	5250.0	5088.0664	601.4348	643.1846
110.0	5500.0	5330.3555	640.6428	685.1143
115.0	5750.0	5572.6445	680.4954	727.7334
120.0	6000.0	5814.9336	720.9717	771.0193
125.0	6250.0	6057.2227	762.0562	814.9558
130.0	6500.0	6299.5117	803.7327	859.5254
135.0	6750.0	6541.8008	845.9851	904.7107
140.0	7000.0	6784.0898	888.8020	950.5000
145.0	7250.0	7026.3789	932.1692	996.8774

TABLE D-XXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS= 1.00 2.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	241.7934	248.8843
55.0	2750.0	2665.1794	275.1938	283.2642
60.0	3000.0	2907.4685	309.6995	318.7817
65.0	3250.0	3149.7576	345.2498	355.3745
70.0	3500.0	3392.0466	381.7920	392.9885
75.0	3750.0	3634.3357	419.2815	431.5774
80.0	4000.0	3876.6248	457.6748	471.0967
85.0	4250.0	4118.9102	496.9363	511.5095
90.0	4500.0	4361.1992	537.0337	552.7830
95.0	4750.0	4603.4883	577.9353	594.8840
100.0	5000.0	4845.7773	619.6150	637.7859
105.0	5250.0	5088.0664	662.0466	681.4619
110.0	5500.0	5330.3555	705.2061	725.8872
115.0	5750.0	5572.6445	749.0750	771.0425
120.0	6000.0	5814.9336	793.6304	816.9045
125.0	6250.0	6057.2227	838.8552	863.4558
130.0	6500.0	6299.5117	884.7319	910.6777
135.0	6750.0	6541.8008	931.2424	958.5522
140.0	7000.0	6784.0898	978.3745	1007.0667
145.0	7250.0	7026.3789	1026.1121	1056.2041

TABLE D-XXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS= 3.00 5.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	253.1281	258.5779
55.0	2750.0	2665.1794	288.0942	294.2969
60.0	3000.0	2907.4685	324.2173	331.1978
65.0	3250.0	3149.7576	361.4341	369.2158
70.0	3500.0	3392.0466	399.6895	408.2947
75.0	3750.0	3634.3357	438.9363	448.3867
80.0	4000.0	3876.6248	479.1294	489.4451
85.0	4250.0	4118.9102	520.2314	531.4319
90.0	4500.0	4361.1992	562.2085	574.3127
95.0	4750.0	4603.4883	605.0276	618.0537
100.0	5000.0	4845.7773	648.6611	662.6267
105.0	5250.0	5088.0664	693.0818	708.0039
110.0	5500.0	5330.3555	738.2644	754.1592
115.0	5750.0	5572.6445	784.1899	801.0735
120.0	6000.0	5814.9336	830.8340	848.7217
125.0	6250.0	6057.2227	878.1790	897.0859
130.0	6500.0	6299.5117	926.2061	946.1472
135.0	6750.0	6541.8008	974.8970	995.8865
140.0	7000.0	6784.0898	1024.2385	1046.2903
145.0	7250.0	7026.3789	1074.2139	1097.3416

TABLE D-XXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS=			7.00	10.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	262.2312	266.1609
55.0	2750.0	2665.1794	298.4551	302.9275
60.0	3000.0	2907.4685	335.8772	340.9104
65.0	3250.0	3149.7576	374.4326	380.0435
70.0	3500.0	3392.0466	414.0637	420.2683
75.0	3750.0	3634.3357	454.7219	461.5359
80.0	4000.0	3876.6248	496.3606	503.7986
85.0	4250.0	4118.9102	538.9407	547.0166
90.0	4500.0	4361.1992	582.4275	591.1550
95.0	4750.0	4603.4883	626.7864	636.1787
100.0	5000.0	4845.7773	671.9890	682.0588
105.0	5250.0	5088.0664	718.0073	728.7666
110.0	5500.0	5330.3555	764.8149	776.2756
115.0	5750.0	5572.6445	812.3918	824.5654
120.0	6000.0	5814.9336	860.7134	873.6111
125.0	6250.0	6057.2227	909.7610	923.3938
130.0	6500.0	6299.5117	959.5156	973.8938
135.0	6750.0	6541.8008	1009.9575	1025.0916
140.0	7000.0	6784.0898	1061.0735	1076.9736
145.0	7250.0	7026.3789	1112.8462	1129.5220

TABLE D-XXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS=		20.00	30.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	273.9663	278.6379
55.0	2750.0	2665.1794	311.8110	317.1279
60.0	3000.0	2907.4685	350.9082	356.8916
65.0	3250.0	3149.7576	391.1887	397.8591
70.0	3500.0	3392.0466	432.5933	439.9697
75.0	3750.0	3634.3357	475.0710	483.1719
80.0	4000.0	3876.6248	518.5730	527.4155
85.0	4250.0	4118.9102	563.0588	572.6597
90.0	4500.0	4361.1992	608.4915	618.8672
95.0	4750.0	4603.4883	654.8354	666.0015
100.0	5000.0	4845.7773	702.0610	714.0325
105.0	5250.0	5088.0664	750.1387	762.9297
110.0	5500.0	5330.3555	799.0410	812.6660
115.0	5750.0	5572.6445	848.7471	863.2195
120.0	6000.0	5814.9336	899.2310	914.5645
125.0	6250.0	6057.2227	950.4736	966.6807
130.0	6500.0	6299.5117	1002.4546	1019.5481
135.0	6750.0	6541.8008	1055.1538	1073.1460
140.0	7000.0	6784.0898	1108.5574	1127.4600
145.0	7250.0	7026.3789	1162.6470	1182.4719

TABLE D-XXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS= 40.00 50.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	282.0007	284.6367
55.0	2750.0	2665.1794	320.9553	323.9556
60.0	3000.0	2907.4685	361.1987	364.5752
65.0	3250.0	3149.7576	402.6606	406.4248
70.0	3500.0	3392.0466	445.2795	449.4419
75.0	3750.0	3634.3357	489.0029	493.5742
80.0	4000.0	3876.6248	533.7808	538.7705
85.0	4250.0	4118.9102	579.5708	584.9888
90.0	4500.0	4361.1992	626.3359	632.1909
95.0	4750.0	4603.4883	674.0391	680.3401
100.0	5000.0	4845.7773	722.6497	729.4050
105.0	5250.0	5088.0664	772.1372	779.3550
110.0	5500.0	5330.3555	822.4734	830.1619
115.0	5750.0	5572.6445	873.6372	881.8040
120.0	6000.0	5814.9336	925.6018	934.2542
125.0	6250.0	6057.2227	978.3469	987.4924
130.0	6500.0	6299.5117	1031.8525	1041.4980
135.0	6750.0	6541.8008	1086.0972	1096.2500
140.0	7000.0	6784.0898	1141.0667	1151.7334
145.0	7250.0	7026.3789	1196.7424	1207.9294

TABLE D-XXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS=			60.00	70.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	286.8093	288.6587
55.0	2750.0	2665.1794	326.4280	328.5332
60.0	3000.0	2907.4685	367.3577	369.7268
65.0	3250.0	3149.7576	409.5266	412.1675
70.0	3500.0	3392.0466	452.8721	455.7927
75.0	3750.0	3634.3357	497.3413	500.5486
80.0	4000.0	3876.6248	542.8826	546.3833
85.0	4250.0	4118.9102	589.4534	593.2546
90.0	4500.0	4361.1992	637.0161	641.1240
95.0	4750.0	4603.4883	685.5325	689.9534
100.0	5000.0	4845.7773	734.9719	739.7117
105.0	5250.0	5088.0664	785.3032	790.3674
110.0	5500.0	5330.3555	836.4978	841.8923
115.0	5750.0	5572.6445	888.5342	894.2642
120.0	6000.0	5814.9336	941.3848	947.4556
125.0	6250.0	6057.2227	995.0293	1001.4460
130.0	6500.0	6299.5117	1049.4470	1056.2148
135.0	6750.0	6541.8008	1104.6167	1111.7402
140.0	7000.0	6784.0898	1160.5237	1168.0076
145.0	7250.0	7026.3789	1217.1487	1224.9978

TABLE D-XXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS=		80.00	90.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	290.2705	291.7000
55.0	2750.0	2665.1794	330.3677	331.9941
60.0	3000.0	2907.4685	371.7913	373.6218
65.0	3250.0	3149.7576	414.4690	416.5098
70.0	3500.0	3392.0466	458.3376	460.5945
75.0	3750.0	3634.3357	503.3435	505.8218
80.0	4000.0	3876.6248	549.4343	552.1396
85.0	4250.0	4118.9102	596.5674	599.5046
90.0	4500.0	4361.1992	644.7039	647.8784
95.0	4750.0	4603.4883	693.8059	697.2222
100.0	5000.0	4845.7773	743.8420	747.5046
105.0	5250.0	5088.0664	794.7808	798.6941
110.0	5500.0	5330.3555	846.5933	850.7617
115.0	5750.0	5572.6445	899.2576	903.6853
120.0	6000.0	5814.9336	952.7458	957.4370
125.0	6250.0	6057.2227	1007.0381	1011.9963
130.0	6500.0	6299.5117	1062.1125	1067.3420
135.0	6750.0	6541.8008	1117.9480	1123.4524
140.0	7000.0	6784.0898	1174.5295	1180.3127
145.0	7250.0	7026.3789	1231.8381	1237.9033

TABLE D-XXX

ALTERNATING STRESS / STATIC STRESS =A= 0.10

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN TIME IN HOURS= 17.00	DYNAMIC STRAIN MICROIN/IN TIME IN HOURS= 20.00
500.0	50.0	526.4829	33.5067	33.5070
750.0	75.0	789.7244	58.1050	58.1066
1000.0	100.0	1052.9661	85.8759	85.8818
1250.0	125.0	1316.2075	116.2803	116.2962
1500.0	150.0	1579.4490	148.9732	149.0092
1750.0	175.0	1842.6907	183.7158	183.7876
2000.0	200.0	2105.9321	220.3338	220.4643
2250.0	225.0	2369.1736	258.6978	258.9189
2500.0	250.0	2632.4153	298.7104	299.0652
2750.0	275.0	2895.6567	340.2996	340.8433
3000.0	300.0	3158.8982	383.4146	384.2175
3250.0	325.0	3422.1396	428.0195	429.1685
3500.0	350.0	3685.3813	474.0952	475.6968
3750.0	375.0	3948.6228	521.6333	523.8147
4000.0	400.0	4211.8633	570.6399	573.5530
4250.0	425.0	4475.1055	621.1309	624.9529
4500.0	450.0	4738.3437	673.1316	678.0691
4750.0	475.0	5001.5859	726.6790	732.9695
5000.0	500.0	5264.8281	781.8193	789.7351
5250.0	525.0	5528.0703	838.6067	848.4565

TABLE D-XXX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=		30.00	40.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	33.5079	33.5087
750.0	75.0	789.7244	58.1120	58.1174
1000.0	100.0	1052.9661	85.9013	85.9208
1250.0	125.0	1316.2075	116.3491	116.4021
1500.0	150.0	1579.4490	149.1291	149.2490
1750.0	175.0	1842.6907	184.0268	184.2660
2000.0	200.0	2105.9321	220.8994	221.3345
2250.0	225.0	2369.1736	259.6565	260.3940
2500.0	250.0	2632.4153	300.2476	301.4299
2750.0	275.0	2895.6567	342.6555	344.4675
3000.0	300.0	3158.8982	386.8936	389.5696
3250.0	325.0	3422.1396	432.9988	436.8291
3500.0	350.0	3685.3813	481.0352	486.3738
3750.0	375.0	3948.6228	531.0867	538.3586
4000.0	400.0	4211.8633	583.2629	592.9729
4250.0	425.0	4475.1055	637.6929	650.4329
4500.0	450.0	4738.3437	694.5273	710.9856
4750.0	475.0	5001.5859	753.9385	774.9075
5000.0	500.0	5264.8281	816.1213	842.5076
5250.0	525.0	5528.0703	881.2891	914.1216

TABLE D-XXX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=			50.00	60.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	33.5096	33.5105
750.0	75.0	789.7244	58.1228	58.1281
1000.0	100.0	1052.9661	85.9403	85.9598
1250.0	125.0	1316.2075	116.4551	116.5081
1500.0	150.0	1579.4490	149.3689	149.4888
1750.0	175.0	1842.6907	184.5052	184.7445
2000.0	200.0	2105.9321	221.7696	222.2048
2250.0	225.0	2369.1736	261.1316	261.8691
2500.0	250.0	2632.4153	302.6123	303.7947
2750.0	275.0	2895.6567	346.2798	348.0920
3000.0	300.0	3158.8982	392.2456	394.9216
3250.0	325.0	3422.1396	440.6594	444.4897
3500.0	350.0	3685.3813	491.7122	497.0505
3750.0	375.0	3948.6228	545.6306	552.9026
4000.0	400.0	4211.8633	602.6831	612.3931
4250.0	425.0	4475.1055	663.1731	675.9131
4500.0	450.0	4738.3437	727.4438	743.9019
4750.0	475.0	5001.5859	795.8765	816.8452
5000.0	500.0	5264.8281	868.8936	895.2798
5250.0	525.0	5528.0703	946.9543	979.7869

TABLE D-XXX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=		70.00		80.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	33.5114	33.5122
750.0	75.0	789.7244	58.1335	58.1389
1000.0	100.0	1052.9661	85.9793	85.9988
1250.0	125.0	1316.2075	116.5611	116.6141
1500.0	150.0	1579.4490	149.6087	149.7287
1750.0	175.0	1842.6907	184.9837	185.2229
2000.0	200.0	2105.9321	222.6399	223.0750
2250.0	225.0	2369.1736	262.6067	263.3440
2500.0	250.0	2632.4153	304.9771	306.1594
2750.0	275.0	2895.6567	349.9041	351.7163
3000.0	300.0	3158.8982	397.5977	400.2737
3250.0	325.0	3422.1396	448.3201	452.1501
3500.0	350.0	3685.3813	502.3892	507.7275
3750.0	375.0	3948.6228	560.1743	567.4463
4000.0	400.0	4211.8633	622.1030	631.8130
4250.0	425.0	4475.1055	688.6531	701.3931
4500.0	450.0	4738.3437	760.3601	776.8184
4750.0	475.0	5001.5859	837.8142	858.7830
5000.0	500.0	5264.8281	921.6660	948.0520
5250.0	525.0	5528.0703	1012.6194	1045.4519

TABLE D-XXX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.10

TIME IN HOURS=			90.00	100.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	50.0	526.4829	33.5131	33.5140
750.0	75.0	789.7244	58.1443	58.1496
1000.0	100.0	1052.9661	86.0183	86.0378
1250.0	125.0	1316.2075	116.6671	116.7200
1500.0	150.0	1579.4490	149.8486	149.9685
1750.0	175.0	1842.6907	185.4621	185.7014
2000.0	200.0	2105.9321	223.5101	223.9452
2250.0	225.0	2369.1736	264.0815	264.8191
2500.0	250.0	2632.4153	307.3418	308.5242
2750.0	275.0	2895.6567	353.5286	355.3406
3000.0	300.0	3158.8982	402.9497	405.6257
3250.0	325.0	3422.1396	455.9805	459.8108
3500.0	350.0	3685.3813	513.0659	518.4045
3750.0	375.0	3948.6228	574.7183	581.9902
4000.0	400.0	4211.8633	641.5232	651.2332
4250.0	425.0	4475.1055	714.1333	726.8733
4500.0	450.0	4738.3437	793.2766	809.7346
4750.0	475.0	5001.5859	879.7520	900.7209
5000.0	500.0	5264.8281	974.4382	1000.8242
5250.0	525.0	5528.0703	1078.2847	1111.1172

TABLE D-XXXI

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=			17.00	20.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	37.1967	37.1971
750.0	150.0	852.8938	64.5047	64.5070
1000.0	200.0	1137.1917	95.3366	95.3449
1250.0	250.0	1421.4895	129.0961	129.1186
1500.0	300.0	1705.7876	165.4035	165.4543
1750.0	350.0	1990.0854	203.9971	204.0984
2000.0	400.0	2274.3835	244.6890	244.8733
2250.0	450.0	2558.6814	287.3408	287.6531
2500.0	500.0	2842.9792	331.8540	332.3547
2750.0	550.0	3127.2773	378.1562	378.9238
3000.0	600.0	3411.5752	426.2012	427.3342
3250.0	650.0	3695.8730	475.9619	477.5840
3500.0	700.0	3980.1711	527.4292	529.6902
3750.0	750.0	4264.4687	580.6111	583.6907
4000.0	800.0	4548.7656	635.5283	639.6404
4250.0	850.0	4833.0625	692.2183	697.6135
4500.0	900.0	5117.3594	750.7305	757.7002
4750.0	950.0	5401.6602	811.1272	820.0073
5000.0	1000.0	5685.9570	873.4822	884.6565
5250.0	1050.0	5970.2539	937.8831	951.7874

TABLE D-XXXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=			30.00	40.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	37.1983	37.1995
750.0	150.0	852.8938	64.5146	64.5222
1000.0	200.0	1137.1917	95.3724	95.3999
1250.0	250.0	1421.4895	129.1934	129.2682
1500.0	300.0	1705.7876	165.6236	165.7928
1750.0	350.0	1990.0854	204.4361	204.7738
2000.0	400.0	2274.3835	245.4875	246.1017
2250.0	450.0	2558.6814	288.6941	289.7351
2500.0	500.0	2842.9792	334.0239	335.6929
2750.0	550.0	3127.2773	381.4819	384.0400
3000.0	600.0	3411.5752	431.1118	434.8894
3250.0	650.0	3695.8730	482.9910	488.3979
3500.0	700.0	3980.1711	537.2261	544.7620
3750.0	750.0	4264.4687	593.9558	604.2212
4000.0	800.0	4548.7656	653.3474	667.0542
4250.0	850.0	4833.0625	715.5977	733.5818
4500.0	900.0	5117.3594	780.9331	804.1658
4750.0	950.0	5401.6602	849.6077	879.2080
5000.0	1000.0	5685.9570	921.9038	959.1511
5250.0	1050.0	5970.2539	998.1348	1044.4819

TABLE D-XXXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=		50.00	60.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	37.2008	37.2020
750.0	150.0	852.8938	64.5297	64.5373
1000.0	200.0	1137.1917	95.4275	95.4550
1250.0	250.0	1421.4895	129.3429	129.4177
1500.0	300.0	1705.7876	165.9621	166.1314
1750.0	350.0	1990.0854	205.1115	205.4492
2000.0	400.0	2274.3835	246.7160	247.3302
2250.0	450.0	2558.6814	290.7764	291.8174
2500.0	500.0	2842.9792	337.3621	339.0312
2750.0	550.0	3127.2773	386.5981	389.1562
3000.0	600.0	3411.5752	438.6670	442.4446
3250.0	650.0	3695.8730	493.8049	499.2117
3500.0	700.0	3980.1711	552.2979	559.8337
3750.0	750.0	4264.4687	614.4863	624.7517
4000.0	800.0	4548.7656	680.7612	694.4680
4250.0	850.0	4833.0625	751.5659	769.5503
4500.0	900.0	5117.3594	827.3987	850.6316
4750.0	950.0	5401.6602	908.8081	938.4084
5000.0	1000.0	5685.9570	996.3984	1033.6460
5250.0	1050.0	5970.2539	1090.8293	1137.1765

TABLE D-XXXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=		70.00		80.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN. MICROIN/IN
500.0	100.0	568.5957	37.2032	37.2045
750.0	150.0	852.8933	64.5449	64.5525
1000.0	200.0	1137.1917	95.4825	95.5100
1250.0	250.0	1421.4895	129.4925	129.5673
1500.0	300.0	1705.7876	166.3007	166.4699
1750.0	350.0	1990.0854	205.7869	206.1246
2000.0	400.0	2274.3835	247.9444	248.5586
2250.0	450.0	2558.6814	292.8584	293.8997
2500.0	500.0	2842.9792	340.7002	342.3694
2750.0	550.0	3127.2773	391.7144	394.2722
3000.0	600.0	3411.5752	446.2222	449.9998
3250.0	650.0	3695.8730	504.6187	510.0256
3500.0	700.0	3980.1711	567.3696	574.9055
3750.0	750.0	4264.4687	635.0168	645.2820
4000.0	800.0	4548.7656	708.1750	721.8818
4250.0	850.0	4833.0625	787.5344	805.5186
4500.0	900.0	5117.3594	873.8643	897.0969
4750.0	950.0	5401.6602	968.0088	997.6089
5000.0	1000.0	5685.9570	1070.8933	1108.1404
5250.0	1050.0	5970.2539	1183.5239	1229.8708

TABLE D-XXXI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.20

TIME IN HOURS=		90.00	100.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	100.0	568.5957	37.2057	37.2069
750.0	150.0	852.8938	64.5601	64.5677
1000.0	200.0	1137.1917	95.5376	95.5651
1250.0	250.0	1421.4895	129.6421	129.7169
1500.0	300.0	1705.7876	166.6392	166.8085
1750.0	350.0	1990.0854	206.4623	206.7999
2000.0	400.0	2274.3835	249.1729	249.7871
2250.0	450.0	2558.6814	294.9407	295.9817
2500.0	500.0	2842.9792	344.0383	345.7075
2750.0	550.0	3127.2773	396.8306	399.3884
3000.0	600.0	3411.5752	453.7773	457.5549
3250.0	650.0	3695.8730	515.4326	520.8394
3500.0	700.0	3980.1711	582.4414	589.9775
3750.0	750.0	4264.4687	655.5474	665.8125
4000.0	800.0	4548.7656	735.5889	749.2959
4250.0	850.0	4833.0625	823.5027	841.4868
4500.0	900.0	5117.3594	920.3298	943.5627
4750.0	950.0	5401.6602	1027.2092	1056.8096
5000.0	1000.0	5685.9570	1145.3879	1182.6353
5250.0	1050.0	5970.2539	1276.2185	1322.5657

TABLE D-XXXII

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=			17.00	20.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	41.1803	41.1808
750.0	225.0	919.2629	71.4140	71.4172
1000.0	300.0	1225.6841	105.5520	105.5635
1250.0	375.0	1532.1050	142.9365	142.9678
1500.0	450.0	1838.5261	183.1513	183.2224
1750.0	525.0	2144.9473	225.9124	226.0541
2000.0	600.0	2451.3682	271.0178	271.2756
2250.0	675.0	2757.7893	318.3250	318.7620
2500.0	750.0	3064.2102	367.7329	368.4336
2750.0	825.0	3370.6313	419.1755	420.2493
3000.0	900.0	3677.0525	472.6155	474.2007
3250.0	975.0	3983.4734	528.0366	530.3057
3500.0	1050.0	4289.8945	585.4509	588.6135
3750.0	1125.0	4596.3125	644.8850	649.1931
4000.0	1200.0	4902.7344	706.3867	712.1394
4250.0	1275.0	5209.1562	770.0229	777.5708
4500.0	1350.0	5515.5781	835.8728	845.6233
4750.0	1425.0	5821.9961	904.0381	916.4609
5000.0	1500.0	6128.4180	974.6321	990.2642
5250.0	1575.0	6434.8398	1047.7900	1067.2415

TABLE D-XXXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=			30.00	40.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	41.1825	41.1843
750.0	225.0	919.2629	71.4278	71.4384
1000.0	300.0	1225.6841	105.6020	105.6405
1250.0	375.0	1532.1050	143.0725	143.1771
1500.0	450.0	1838.5261	183.4592	183.6960
1750.0	525.0	2144.9473	226.5265	226.9989
2000.0	600.0	2451.3682	272.1350	272.9941
2250.0	675.0	2757.7893	320.2185	321.6748
2500.0	750.0	3064.2102	370.7686	373.1035
2750.0	825.0	3370.6313	423.8279	427.4065
3000.0	900.0	3677.0525	479.4854	484.7700
3250.0	975.0	3983.4734	537.8696	545.4336
3500.0	1050.0	4289.8945	599.1558	609.6980
3750.0	1125.0	4596.3125	663.5537	677.9143
4000.0	1200.0	4902.7344	731.3145	750.4895
4250.0	1275.0	5209.1562	802.7297	827.8889
4500.0	1350.0	5515.5781	878.1250	910.6265
4750.0	1425.0	5821.9961	957.8704	999.2798
5000.0	1500.0	6128.4180	1042.3706	1094.4771
5250.0	1575.0	6434.8398	1132.0791	1196.9167

TABLE D-XXXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=		50.00	60.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	41.1860	41.1877
750.0	225.0	919.2629	71.4490	71.4596
1000.0	300.0	1225.6841	105.6790	105.7175
1250.0	375.0	1532.1050	143.2817	143.3864
1500.0	450.0	1838.5261	183.9328	184.1696
1750.0	525.0	2144.9473	227.4714	227.9438
2000.0	600.0	2451.3682	273.8535	274.7126
2250.0	675.0	2757.7893	323.1313	324.5876
2500.0	750.0	3064.2102	375.4385	377.7734
2750.0	825.0	3370.6313	430.9851	434.5640
3000.0	900.0	3677.0525	490.0547	495.3394
3250.0	975.0	3983.4734	552.9976	560.5613
3500.0	1050.0	4289.8945	620.2402	630.7825
3750.0	1125.0	4596.3125	692.2749	706.6355
4000.0	1200.0	4902.7344	769.6646	788.8396
4250.0	1275.0	5209.1562	853.0479	878.2068
4500.0	1350.0	5515.5781	943.1282	975.6299
4750.0	1425.0	5821.9961	1040.6892	1082.0986
5000.0	1500.0	6128.4180	1146.5835	1198.6899
5250.0	1575.0	6434.8398	1261.7544	1326.5923

TABLE D-XXXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=			70.00	80.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	41.1894	41.1912
750.0	225.0	919.2629	71.4702	71.4809
1000.0	300.0	1225.6841	105.7560	105.7946
1250.0	375.0	1532.1050	143.4910	143.5956
1500.0	450.0	1838.5261	184.4064	184.6432
1750.0	525.0	2144.9473	228.4162	228.8886
2000.0	600.0	2451.3682	275.5720	276.4312
2250.0	675.0	2757.7893	326.0442	327.5005
2500.0	750.0	3064.2102	380.1084	382.4434
2750.0	825.0	3370.6313	438.1426	441.7212
3000.0	900.0	3677.0525	500.6240	505.9087
3250.0	975.0	3983.4734	568.1252	575.6892
3500.0	1050.0	4289.8945	641.3247	651.8669
3750.0	1125.0	4596.3125	720.9961	735.3567
4000.0	1200.0	4902.7344	808.0146	827.1895
4250.0	1275.0	5209.1562	903.3660	928.5249
4500.0	1350.0	5515.5781	1008.1313	1040.6328
4750.0	1425.0	5821.9961	1123.5078	1164.9172
5000.0	1500.0	6128.4180	1250.7966	1302.9028
5250.0	1575.0	6434.8398	1391.4299	1456.2673

TABLE D-XXXII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.30

TIME IN HOURS=			90.00	100.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	150.0	612.8420	41.1929	41.1946
750.0	225.0	919.2629	71.4915	71.5021
1000.0	300.0	1225.6841	105.8331	105.8716
1250.0	375.0	1532.1050	143.7003	143.8049
1500.0	450.0	1838.5261	184.8800	185.1168
1750.0	525.0	2144.9473	229.3610	229.8334
2000.0	600.0	2451.3682	277.2905	278.1499
2250.0	675.0	2757.7893	328.9570	330.4133
2500.0	750.0	3064.2102	384.7783	387.1133
2750.0	825.0	3370.6313	445.2998	448.8787
3000.0	900.0	3677.0525	511.1934	516.4780
3250.0	975.0	3983.4734	583.2532	590.8171
3500.0	1050.0	4289.8945	662.4092	672.9514
3750.0	1125.0	4596.3125	749.7173	764.0779
4000.0	1200.0	4902.7344	846.3647	865.5398
4250.0	1275.0	5209.1562	953.6838	978.8428
4500.0	1350.0	5515.5781	1073.1345	1105.6362
4750.0	1425.0	5821.9961	1206.3267	1247.7358
5000.0	1500.0	6128.4180	1355.0095	1407.1160
5250.0	1575.0	6434.8398	1521.1052	1585.9429

TABLE D-XXXIII

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=		17.00		20.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	49.6407	49.6417
750.0	375.0	1054.8926	86.0893	86.0952
1000.0	500.0	1406.5237	127.2529	127.2742
1250.0	625.0	1758.1545	172.3471	172.4053
1500.0	750.0	2109.7854	220.8831	221.0147
1750.0	875.0	2461.4163	272.5352	272.7976
2000.0	1000.0	2813.0474	327.0823	327.5598
2250.0	1125.0	3164.6782	384.3777	385.1873
2500.0	1250.0	3516.3091	444.3340	445.6316
2750.0	1375.0	3867.9402	506.9077	508.8965
3000.0	1500.0	4219.5703	572.0969	575.0339
3250.0	1625.0	4571.1992	639.9373	644.1409
3500.0	1750.0	4922.8320	710.4044	716.3533
3750.0	1875.0	5274.4609	783.8677	791.8486
4000.0	2000.0	5626.0937	860.1865	870.8430
4250.0	2125.0	5977.7227	939.6040	953.5862
4500.0	2250.0	6329.3555	1022.3071	1040.3701
4750.0	2375.0	6680.9844	1108.5112	1131.5249
5000.0	2500.0	7032.6172	1198.4551	1227.4141
5250.0	2625.0	7384.2461	1292.4060	1328.4399

TABLE D-XXXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=		30.00		40.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	49.6449	49.6481
750.0	375.0	1054.8926	86.1148	86.1345
1000.0	500.0	1406.5237	127.3456	127.4169
1250.0	625.0	1758.1545	172.5991	172.7929
1500.0	750.0	2109.7854	221.4534	221.8921
1750.0	875.0	2461.4163	273.6729	274.5479
2000.0	1000.0	2813.0474	329.1516	330.7434
2250.0	1125.0	3164.6782	387.8853	390.5833
2500.0	1250.0	3516.3091	449.9573	454.2827
2750.0	1375.0	3867.9402	515.5261	522.1555
3000.0	1500.0	4219.5703	584.8240	594.6138
3250.0	1625.0	4571.1992	658.1531	672.1655
3500.0	1750.0	4922.8320	735.8831	755.4126
3750.0	1875.0	5274.4609	818.4519	845.0552
4000.0	2000.0	5626.0937	906.3652	941.8875
4250.0	2125.0	5977.7227	1000.1938	1046.8015
4500.0	2250.0	6329.3555	1100.5801	1160.7898
4750.0	2375.0	6680.9844	1208.2366	1284.9482
5000.0	2500.0	7032.6172	1323.9438	1420.4736
5250.0	2625.0	7384.2461	1448.5530	1568.6663

TABLE D-XXXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=		50.00	60.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	49.6512	49.6544
750.0	375.0	1054.8926	86.1542	86.1738
1000.0	500.0	1406.5237	127.4882	127.5596
1250.0	625.0	1758.1545	172.9868	173.1806
1500.0	750.0	2109.7854	222.3308	222.7695
1750.0	875.0	2461.4163	275.4231	276.2983
2000.0	1000.0	2813.0474	332.3352	333.9270
2250.0	1125.0	3164.6782	393.2815	395.9795
2500.0	1250.0	3516.3091	458.6084	462.9341
2750.0	1375.0	3867.9402	528.7852	535.4148
3000.0	1500.0	4219.5703	604.4038	614.1936
3250.0	1625.0	4571.1992	686.1777	700.1899
3500.0	1750.0	4922.8320	774.9424	794.4722
3750.0	1875.0	5274.4609	871.6584	898.2617
4000.0	2000.0	5626.0937	977.4097	1012.9316
4250.0	2125.0	5977.7227	1093.4089	1140.0166
4500.0	2250.0	6329.3555	1220.9998	1281.2097
4750.0	2375.0	6680.9844	1361.6599	1438.3718
5000.0	2500.0	7032.6172	1517.0034	1613.5332
5250.0	2625.0	7384.2461	1688.7793	1808.8923

TABLE D-XXXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=		70.00	80.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	49.6576	49.6608
750.0	375.0	1054.8926	86.1935	86.2131
1000.0	500.0	1406.5237	127.6309	127.7022
1250.0	625.0	1758.1545	173.3744	173.5683
1500.0	750.0	2109.7854	223.2082	223.6469
1750.0	875.0	2461.4163	277.1733	278.0486
2000.0	1000.0	2813.0474	335.5188	337.1106
2250.0	1125.0	3164.6782	398.6775	401.3755
2500.0	1250.0	3516.3091	467.2595	471.5852
2750.0	1375.0	3867.9402	542.0442	548.6738
3000.0	1500.0	4219.5703	623.9836	633.7734
3250.0	1625.0	4571.1992	714.2024	728.2146
3500.0	1750.0	4922.8320	814.0017	833.5315
3750.0	1875.0	5274.4609	924.8650	951.4680
4000.0	2000.0	5626.0937	1048.4539	1083.9758
4250.0	2125.0	5977.7227	1186.6243	1233.2314
4500.0	2250.0	6329.3555	1341.4194	1401.6292
4750.0	2375.0	6680.9844	1515.0835	1591.7949
5000.0	2500.0	7032.6172	1710.0630	1806.5923
5250.0	2625.0	7384.2461	1929.0056	2049.1182

TABLE D-XXXIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.50

TIME IN HOURS=		90.00	100.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	250.0	703.2617	49.6640	49.6672
750.0	375.0	1054.8926	86.2328	86.2525
1000.0	500.0	1406.5237	127.7736	127.8449
1250.0	625.0	1758.1545	173.7621	173.9559
1500.0	750.0	2109.7854	224.0856	224.5243
1750.0	875.0	2461.4163	278.9238	279.7988
2000.0	1000.0	2813.0474	338.7024	340.2942
2250.0	1125.0	3164.6782	404.0737	406.7717
2500.0	1250.0	3516.3091	475.9109	480.2363
2750.0	1375.0	3867.9402	555.3035	561.9329
3000.0	1500.0	4219.5703	643.5635	653.3533
3250.0	1625.0	4571.1992	742.2268	756.2393
3500.0	1750.0	4922.8320	853.0610	872.5908
3750.0	1875.0	5274.4609	978.0715	1004.6746
4000.0	2000.0	5626.0937	1119.4983	1155.0203
4250.0	2125.0	5977.7227	1279.8394	1326.4468
4500.0	2250.0	6329.3555	1461.8391	1522.0488
4750.0	2375.0	6680.9844	1668.5068	1745.2185
5000.0	2500.0	7032.6172	1903.1226	1999.6521
5250.0	2625.0	7384.2461	2169.2317	2289.3445

TABLE D-XXXIV

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS= 17.00 20.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	46.7190	46.7198
600.0	480.0	1008.7993	81.0212	81.0260
800.0	640.0	1345.0659	119.7576	119.7751
1000.0	800.0	1681.3325	162.1876	162.2352
1200.0	960.0	2017.5989	207.8459	207.9537
1400.0	1120.0	2353.8655	256.4207	256.6355
1600.0	1280.0	2690.1321	307.6960	308.0869
1800.0	1440.0	3026.3984	361.5251	362.1877
2000.0	1600.0	3362.6650	417.8127	418.8750
2200.0	1760.0	3698.9316	476.5063	478.1343
2400.0	1920.0	4035.1980	537.5879	539.9922
2600.0	2080.0	4371.4609	601.0728	604.5139
2800.0	2240.0	4707.7305	667.0054	671.8015
3000.0	2400.0	5043.9961	735.4543	741.9875
3200.0	2560.0	5380.2617	806.5142	815.2378
3400.0	2720.0	5716.5273	880.3083	891.7542
3600.0	2880.0	6052.7969	956.9785	971.7646
3800.0	3040.0	6389.0625	1036.6926	1055.5312
4000.0	3200.0	6725.3281	1119.6418	1143.3477
4200.0	3360.0	7061.5937	1206.0400	1235.5374

TABLE D-XXXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=			30.00	40.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	46.7224	46.7250
600.0	480.0	1008.7993	81.0421	81.0582
800.0	640.0	1345.0659	119.8335	119.8919
1000.0	800.0	1681.3325	162.3938	162.5525
1200.0	960.0	2017.5989	208.3128	208.6719
1400.0	1120.0	2353.8655	257.3521	258.0684
1600.0	1280.0	2690.1321	309.3899	310.6929
1800.0	1440.0	3026.3984	364.3965	366.6050
2000.0	1600.0	3362.6650	422.4160	425.9568
2200.0	1760.0	3698.9316	483.5613	488.9883
2400.0	1920.0	4035.1980	548.0061	556.0200
2600.0	2080.0	4371.4609	615.9844	627.4548
2800.0	2240.0	4707.7305	687.7886	703.7759
3000.0	2400.0	5043.9961	763.7649	785.5422
3200.0	2560.0	5380.2617	844.3167	873.3953
3400.0	2720.0	5716.5273	929.9070	968.0598
3600.0	2880.0	6052.7969	1021.0522	1070.3398
3800.0	3040.0	6389.0625	1118.3271	1181.1230
4000.0	3200.0	6725.3281	1222.3665	1301.3855
4200.0	3360.0	7061.5937	1333.8613	1432.1855

TABLE D-XXXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=		50.00	60.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	46.7276	46.7302
600.0	480.0	1008.7993	81.0743	81.0904
800.0	640.0	1345.0659	119.9502	120.0086
1000.0	800.0	1681.3325	162.7112	162.8699
1200.0	960.0	2017.5989	209.0310	209.3901
1400.0	1120.0	2353.8655	258.7849	259.5012
1600.0	1280.0	2690.1321	311.9961	313.2991
1800.0	1440.0	3026.3984	368.8137	371.0222
2000.0	1600.0	3362.6650	429.4978	433.0386
2200.0	1760.0	3698.9316	494.4150	499.8420
2400.0	1920.0	4035.1980	564.0342	572.0481
2600.0	2080.0	4371.4609	638.9253	650.3955
2800.0	2240.0	4707.7305	719.7629	735.7502
3000.0	2400.0	5043.9961	807.3196	829.0969
3200.0	2560.0	5380.2617	902.4741	931.5527
3400.0	2720.0	5716.5273	1006.2126	1044.3652
3600.0	2880.0	6052.7969	1119.6274	1168.9150
3800.0	3040.0	6389.0625	1243.9189	1306.7148
4000.0	3200.0	6725.3281	1380.4043	1459.4231
4200.0	3360.0	7061.5937	1530.5095	1628.8337

TABLE D-XXXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=		70.00		80.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	46.7328	46.7355
600.0	480.0	1008.7993	81.1065	81.1226
800.0	640.0	1345.0659	120.0670	120.1254
1000.0	800.0	1681.3325	163.0285	163.1872
1200.0	960.0	2017.5989	209.7492	210.1084
1400.0	1120.0	2353.8655	260.2175	260.9341
1600.0	1280.0	2690.1321	314.6021	315.9050
1800.0	1440.0	3026.3984	373.2310	375.4395
2000.0	1600.0	3362.6650	436.5796	440.1206
2200.0	1760.0	3698.9316	505.2690	510.6958
2400.0	1920.0	4035.1980	580.0620	588.0762
2600.0	2080.0	4371.4609	661.8660	673.3364
2800.0	2240.0	4707.7305	751.7373	767.7244
3000.0	2400.0	5043.9961	850.8743	872.6514
3200.0	2560.0	5380.2617	960.6316	989.7102
3400.0	2720.0	5716.5273	1082.5181	1120.6707
3600.0	2880.0	6052.7969	1218.2026	1267.4900
3800.0	3040.0	6389.0625	1369.5107	1432.3064
4000.0	3200.0	6725.3281	1538.4421	1617.4607
4200.0	3360.0	7061.5937	1727.1577	1825.4814

TABLE D-XXXIV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 0.80

TIME IN HOURS=		90.00	100.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	320.0	672.5330	46.7381	46.7407
600.0	480.0	1008.7993	81.1387	81.1547
800.0	640.0	1345.0659	120.1838	120.2422
1000.0	800.0	1681.3325	163.3459	163.5046
1200.0	960.0	2017.5989	210.4675	210.8266
1400.0	1120.0	2353.8655	261.6504	262.3667
1600.0	1280.0	2690.1321	317.2083	318.5112
1800.0	1440.0	3026.3984	377.6482	379.8567
2000.0	1600.0	3362.6650	443.6614	447.2024
2200.0	1760.0	3698.9316	516.1228	521.5498
2400.0	1920.0	4035.1980	596.0901	604.1040
2600.0	2080.0	4371.4609	684.8069	696.2773
2800.0	2240.0	4707.7305	783.7117	799.6987
3000.0	2400.0	5043.9961	894.4287	916.2061
3200.0	2560.0	5380.2617	1018.7891	1047.8677
3400.0	2720.0	5716.5273	1158.8237	1196.9763
3600.0	2880.0	6052.7969	1316.7776	1366.0652
3800.0	3040.0	6389.0625	1495.1025	1557.8982
4000.0	3200.0	6725.3281	1696.4797	1775.4985
4200.0	3360.0	7061.5937	1923.8057	2022.1296

TABLE D-XXXV

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=		17.00		20.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	53.8052	53.8064
600.0	600.0	1119.3745	93.3137	93.3214
800.0	800.0	1492.4995	137.9379	137.9658
1000.0	1000.0	1865.6243	186.8335	186.9094
1200.0	1200.0	2238.7493	239.4786	239.6503
1400.0	1400.0	2611.8740	295.5305	295.8730
1600.0	1600.0	2984.9990	354.7639	355.3870
1800.0	1800.0	3358.1238	417.0366	418.0925
2000.0	2000.0	3731.2488	482.2732	483.9661
2200.0	2200.0	4104.3711	550.4504	553.0449
2400.0	2400.0	4477.4961	621.5962	625.4275
2600.0	2600.0	4850.6211	695.7791	701.2627
2800.0	2800.0	5223.7461	773.1079	780.7507
3000.0	3000.0	5596.8711	853.7275	864.1384
3200.0	3200.0	5969.9961	937.8245	951.7258
3400.0	3400.0	6343.1211	1025.6147	1043.8542
3600.0	3600.0	6716.2461	1117.3572	1140.9197
3800.0	3800.0	7089.3711	1213.3403	1243.3611
4000.0	4000.0	7462.4961	1313.8870	1351.6628
4200.0	4200.0	7835.6211	1419.3608	1466.3657

TABLE D-XXXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=	30.00	40.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	53.8106	53.8148
600.0	600.0	1119.3745	93.3470	93.3727
800.0	800.0	1492.4995	138.0588	138.1519
1000.0	1000.0	1865.6243	187.1623	187.4151
1200.0	1200.0	2238.7493	240.2225	240.7948
1400.0	1400.0	2611.8740	297.0146	298.1562
1600.0	1600.0	2984.9990	357.4634	359.5398
1800.0	1800.0	3358.1238	421.6121	425.1316
2000.0	2000.0	3731.2488	489.6086	495.2515
2200.0	2200.0	4104.3711	561.6931	570.3413
2400.0	2400.0	4477.4961	638.1980	650.9687
2600.0	2600.0	4850.6211	719.5415	737.8203
2800.0	2800.0	5223.7461	806.2268	831.7031
3000.0	3000.0	5596.8711	898.8413	933.5444
3200.0	3200.0	5969.9961	998.0640	1044.4021
3400.0	3400.0	6343.1211	1104.6521	1165.4502
3600.0	3600.0	6716.2461	1219.4614	1298.0032
3800.0	3800.0	7089.3711	1343.4304	1443.4995
4000.0	4000.0	7462.4961	1477.5825	1603.5022
4200.0	4200.0	7835.6211	1623.0491	1779.7324

TABLE D-XXXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=		50.00		60.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	53.8189	53.8231
600.0	600.0	1119.3745	93.3983	93.4240
800.0	800.0	1492.4995	138.2449	138.3380
1000.0	1000.0	1865.6243	187.6680	187.9208
1200.0	1200.0	2238.7493	241.3671	241.9393
1400.0	1400.0	2611.8740	299.2979	300.4395
1600.0	1600.0	2984.9990	361.6162	363.6926
1800.0	1800.0	3358.1238	428.6511	432.1707
2000.0	2000.0	3731.2488	500.8940	506.5369
2200.0	2200.0	4104.3711	578.9895	587.6377
2400.0	2400.0	4477.4961	663.7393	676.5100
2600.0	2600.0	4850.6211	756.0991	774.3779
2800.0	2800.0	5223.7461	857.1792	882.6555
3000.0	3000.0	5596.8711	968.2473	1002.9504
3200.0	3200.0	5969.9961	1090.7402	1137.0784
3400.0	3400.0	6343.1211	1226.2480	1287.0461
3600.0	3600.0	6716.2461	1376.5447	1455.0864
3800.0	3800.0	7089.3711	1543.5688	1643.6379
4000.0	4000.0	7462.4961	1729.4219	1855.3416
4200.0	4200.0	7835.6211	1936.4158	2093.0991

TABLE D-XXXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=		70.00	80.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	53.8273	53.8314
600.0	600.0	1119.3745	93.4496	93.4753
800.0	800.0	1492.4995	138.4310	138.5241
1000.0	1000.0	1865.6243	188.1737	188.4265
1200.0	1200.0	2238.7493	242.5116	243.0839
1400.0	1400.0	2611.8740	301.5811	302.7227
1600.0	1600.0	2984.9990	365.7693	367.8457
1800.0	1800.0	3358.1238	435.6902	439.2095
2000.0	2000.0	3731.2488	512.1794	517.8220
2200.0	2200.0	4104.3711	596.2856	604.9338
2400.0	2400.0	4477.4961	689.2805	702.0510
2600.0	2600.0	4850.6211	792.6567	810.9355
2800.0	2800.0	5223.7461	908.1316	933.6077
3000.0	3000.0	5596.8711	1037.6533	1072.3562
3200.0	3200.0	5969.9961	1183.4165	1229.7544
3400.0	3400.0	6343.1211	1347.8440	1408.6418
3600.0	3600.0	6716.2461	1533.6282	1612.1694
3800.0	3800.0	7089.3711	1743.7073	1843.7761
4000.0	4000.0	7462.4961	1981.2615	2107.1807
4200.0	4200.0	7835.6211	2249.7822	2406.4648

TABLE D-XXXV (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 1.00

TIME IN HOURS=		90.00	100.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
400.0	400.0	746.2498	53.8356	53.8398
600.0	600.0	1119.3745	93.5009	93.5265
800.0	800.0	1492.4995	138.6171	138.7102
1000.0	1000.0	1865.6243	188.6794	188.9322
1200.0	1200.0	2238.7493	243.6561	244.2284
1400.0	1400.0	2611.8740	303.8643	305.0059
1600.0	1600.0	2984.9990	369.9221	371.9985
1800.0	1800.0	3358.1238	442.7292	446.2485
2000.0	2000.0	3731.2488	523.4648	529.1074
2200.0	2200.0	4104.3711	613.5820	622.2302
2400.0	2400.0	4477.4961	714.8218	727.5923
2600.0	2600.0	4850.6211	829.2144	847.4932
2800.0	2800.0	5223.7461	959.0840	984.5601
3000.0	3000.0	5596.8711	1107.0593	1141.7625
3200.0	3200.0	5969.9961	1276.0928	1322.4307
3400.0	3400.0	6343.1211	1469.4399	1530.2378
3600.0	3600.0	6716.2461	1690.7114	1769.2529
3800.0	3800.0	7089.3711	1943.8457	2043.9148
4000.0	4000.0	7462.4961	2233.1008	2359.0203
4200.0	4200.0	7835.6211	2563.1489	2719.8318

TABLE D-XXXVI

ALTERNATING STRESS / STATIC STRESS =A= 3.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN (TIME IN HOURS= 17.00)	DYNAMIC STRAIN MICROIN/IN (TIME IN HOURS= 20.00)
500.0	1500.0	1863.1528	186.4969	186.5723
550.0	1650.0	2049.4683	212.3286	212.4442
600.0	1800.0	2235.7834	239.0464	239.2170
650.0	1950.0	2422.0986	266.6123	266.8567
700.0	2100.0	2608.4141	294.9956	295.3362
750.0	2250.0	2794.7292	324.1714	324.6350
800.0	2400.0	2981.0447	354.1201	354.7393
850.0	2550.0	3167.3599	384.8252	385.6377
900.0	2700.0	3353.6753	416.2766	417.3262
950.0	2850.0	3539.9905	448.4663	449.8035
1000.0	3000.0	3726.3059	481.3899	483.0728
1050.0	3150.0	3912.6211	515.0459	517.1399
1100.0	3300.0	4098.9336	549.4358	552.0149
1150.0	3450.0	4285.2500	584.5657	587.7129
1200.0	3600.0	4471.5664	620.4429	624.2512
1250.0	3750.0	4657.8789	657.0747	661.6475
1300.0	3900.0	4844.1953	694.4751	699.9263
1350.0	4050.0	5030.5117	732.6597	739.1150
1400.0	4200.0	5216.8281	771.6433	779.2407
1450.0	4350.0	5403.1406	811.4478	820.3389

TABLE D-XXXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=		30.00	40.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	186.8237	187.0750
550.0	1650.0	2049.4683	212.8294	213.2147
600.0	1800.0	2235.7834	239.7859	240.3548
650.0	1950.0	2422.0986	267.6709	268.4851
700.0	2100.0	2608.4141	296.4709	297.6060
750.0	2250.0	2794.7292	326.1809	327.7268
800.0	2400.0	2981.0447	356.8035	358.8677
850.0	2550.0	3167.3599	388.3459	391.0542
900.0	2700.0	3353.6753	420.8250	424.3237
950.0	2850.0	3539.9905	454.2612	458.7187
1000.0	3000.0	3726.3059	488.6819	494.2910
1050.0	3150.0	3912.6211	524.1194	531.0991
1100.0	3300.0	4098.9336	560.6118	569.2085
1150.0	3450.0	4285.2500	598.2041	608.6953
1200.0	3600.0	4471.5664	636.9463	649.6414
1250.0	3750.0	4657.8789	676.8899	692.1323
1300.0	3900.0	4844.1953	718.0969	736.2676
1350.0	4050.0	5030.5117	760.6326	782.1504
1400.0	4200.0	5216.8281	804.5662	829.8916
1450.0	4350.0	5403.1406	849.9758	879.6128

TABLE D-XXXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=			50.00	60.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	187.3264	187.5777
550.0	1650.0	2049.4683	213.5999	213.9852
600.0	1800.0	2235.7834	240.9236	241.4925
650.0	1950.0	2422.0986	269.2993	270.1135
700.0	2100.0	2608.4141	298.7407	299.8755
750.0	2250.0	2794.7292	329.2727	330.8186
800.0	2400.0	2981.0447	360.9319	362.9961
850.0	2550.0	3167.3599	393.7625	396.4707
900.0	2700.0	3353.6753	427.8223	431.3210
950.0	2850.0	3539.9905	463.1765	467.6343
1000.0	3000.0	3726.3059	499.9004	505.5095
1050.0	3150.0	3912.6211	538.0786	545.0583
1100.0	3300.0	4098.9336	577.8054	586.4023
1150.0	3450.0	4285.2500	619.1865	629.6777
1200.0	3600.0	4471.5664	662.3364	675.0315
1250.0	3750.0	4657.8789	707.3750	722.6174
1300.0	3900.0	4844.1953	754.4382	772.6089
1350.0	4050.0	5030.5117	803.6680	825.1858
1400.0	4200.0	5216.8281	855.2170	880.5425
1450.0	4350.0	5403.1406	909.2495	938.8865

TABLE D-XXXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=		70.00	80.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	187.8291	188.0805
550.0	1650.0	2049.4683	214.3704	214.7556
600.0	1800.0	2235.7834	242.0614	242.6303
650.0	1950.0	2422.0986	270.9277	271.7422
700.0	2100.0	2608.4141	301.0105	302.1453
750.0	2250.0	2794.7292	332.3645	333.9104
800.0	2400.0	2981.0447	365.0603	367.1243
850.0	2550.0	3167.3599	399.1792	401.8875
900.0	2700.0	3353.6753	434.8198	438.3184
950.0	2850.0	3539.9905	472.0918	476.5496
1000.0	3000.0	3726.3059	511.1187	516.7278
1050.0	3150.0	3912.6211	552.0378	559.0173
1100.0	3300.0	4098.9336	594.9990	603.5959
1150.0	3450.0	4285.2500	640.1689	650.6602
1200.0	3600.0	4471.5664	687.7266	700.4214
1250.0	3750.0	4657.8789	737.8599	753.1023
1300.0	3900.0	4844.1953	790.7795	808.9502
1350.0	4050.0	5030.5117	846.7034	868.2209
1400.0	4200.0	5216.8281	905.8679	931.1931
1450.0	4350.0	5403.1406	968.5234	998.1602

TABLE D-XXXVI (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 3.00

TIME IN HOURS=		90.00	100.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	1500.0	1863.1528	188.3318	188.5832
550.0	1650.0	2049.4683	215.1409	215.5261
600.0	1800.0	2235.7834	243.1992	243.7680
650.0	1950.0	2422.0986	272.5564	273.3706
700.0	2100.0	2608.4141	303.2803	304.4150
750.0	2250.0	2794.7292	335.4563	337.0022
800.0	2400.0	2981.0447	369.1885	371.2527
850.0	2550.0	3167.3599	404.5957	407.3040
900.0	2700.0	3353.6753	441.8171	445.3159
950.0	2850.0	3539.9905	481.0071	485.4648
1000.0	3000.0	3726.3059	522.3372	527.9463
1050.0	3150.0	3912.6211	565.9971	572.9766
1100.0	3300.0	4098.9336	612.1929	620.7896
1150.0	3450.0	4285.2500	661.1514	671.6426
1200.0	3600.0	4471.5664	713.1165	725.8115
1250.0	3750.0	4657.8789	768.3450	783.5874
1300.0	3900.0	4844.1953	827.1208	845.2915
1350.0	4050.0	5030.5117	889.7388	911.2563
1400.0	4200.0	5216.8281	956.5188	981.8440
1450.0	4350.0	5403.1406	1027.7971	1057.4338

TABLE D-XXXVII

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS= 17.00 20.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	325.2607	325.7295
550.0	2750.0	3081.7488	370.6228	371.3413
600.0	3000.0	3361.9080	417.6833	418.7444
650.0	3250.0	3642.0669	466.4131	467.9321
700.0	3500.0	3922.2258	516.8008	518.9180
750.0	3750.0	4202.3828	568.8494	571.7332
800.0	4000.0	4482.5430	622.5793	626.4299
850.0	4250.0	4762.6992	678.0203	683.0723
900.0	4500.0	5042.8594	735.2187	741.7454
950.0	4750.0	5323.0195	794.2283	802.5437
1000.0	5000.0	5603.1797	855.1204	865.5840
1050.0	5250.0	5883.3359	917.9712	930.9912
1100.0	5500.0	6163.4961	982.8745	998.9114
1150.0	5750.0	6443.6562	1049.9338	1069.5046
1200.0	6000.0	6723.8125	1119.2605	1142.9424
1250.0	6250.0	7003.9727	1190.9805	1219.4146
1300.0	6500.0	7284.1328	1265.2317	1299.1279
1350.0	6750.0	7564.2891	1342.1560	1382.2959
1400.0	7000.0	7844.4492	1421.9199	1469.1628
1450.0	7250.0	8124.6094	1504.6873	1559.9731

TABLE D-XXXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		30.00	40.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	327.2925	328.8555
550.0	2750.0	3081.7488	373.7368	376.1323
600.0	3000.0	3361.9080	422.2817	425.8193
650.0	3250.0	3642.0669	472.9951	478.0583
700.0	3500.0	3922.2258	525.9746	533.0312
750.0	3750.0	4202.3828	581.3457	590.9580
800.0	4000.0	4482.5430	639.2651	652.1003
850.0	4250.0	4762.6992	699.9128	716.7534
900.0	4500.0	5042.8594	763.5007	785.2561
950.0	4750.0	5323.0195	830.2617	857.9795
1000.0	5000.0	5603.1797	900.4626	935.3413
1050.0	5250.0	5883.3359	974.3911	1017.7910
1100.0	5500.0	6163.4961	1052.3677	1105.8240
1150.0	5750.0	6443.6562	1134.7402	1199.9758
1200.0	6000.0	6723.8125	1221.8818	1300.8210
1250.0	6250.0	7003.9727	1314.1943	1408.9741
1300.0	6500.0	7284.1328	1412.1155	1525.1028
1350.0	6750.0	7564.2891	1516.0957	1649.8955
1400.0	7000.0	7844.4492	1626.6394	1784.1162
1450.0	7250.0	8124.6094	1744.2590	1928.5449

TABLE D-XXXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=	50.00	60.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	330.4185	331.9814
550.0	2750.0	3081.7488	378.5278	380.9233
600.0	3000.0	3361.9080	429.3567	432.8938
650.0	3250.0	3642.0669	483.1213	488.1843
700.0	3500.0	3922.2258	540.0879	547.1448
750.0	3750.0	4202.3828	600.5706	610.1829
800.0	4000.0	4482.5430	664.9358	677.7710
850.0	4250.0	4762.6992	733.5940	750.4346
900.0	4500.0	5042.8594	807.0115	828.7668
950.0	4750.0	5323.0195	885.6975	913.4155
1000.0	5000.0	5603.1797	970.2200	1005.0989
1050.0	5250.0	5883.3359	1061.1912	1104.5911
1100.0	5500.0	6163.4961	1159.2803	1212.7363
1150.0	5750.0	6443.6562	1265.2114	1330.4473
1200.0	6000.0	6723.8125	1379.7605	1458.6997
1250.0	6250.0	7003.9727	1503.7539	1598.5337
1300.0	6500.0	7284.1328	1638.0903	1751.0779
1350.0	6750.0	7564.2891	1783.6951	1917.4949
1400.0	7000.0	7844.4492	1941.5928	2099.0696
1450.0	7250.0	8124.6094	2112.8308	2297.1169

TABLE D-XXXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		70.00		80.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	333.5444	335.1072
550.0	2750.0	3081.7488	383.3196	385.7141
600.0	3000.0	3361.9080	436.4314	439.9685
650.0	3250.0	3642.0669	493.2476	498.3105
700.0	3500.0	3922.2258	554.2014	561.2581
750.0	3750.0	4202.3828	619.7954	629.4077
800.0	4000.0	4482.5430	690.6062	703.4414
850.0	4250.0	4762.6992	767.2749	784.1155
900.0	4500.0	5042.8594	850.5222	872.2776
950.0	4750.0	5323.0195	941.1333	968.8511
1000.0	5000.0	5603.1797	1039.9775	1074.8560
1050.0	5250.0	5883.3359	1147.9910	1191.3909
1100.0	5500.0	6163.4961	1266.1926	1319.6487
1150.0	5750.0	6443.6562	1395.6829	1460.9132
1200.0	6000.0	6723.8125	1537.6392	1616.5781
1250.0	6250.0	7003.9727	1693.3135	1788.0928
1300.0	6500.0	7284.1328	1864.0652	1977.0522
1350.0	6750.0	7564.2891	2051.2947	2185.0937
1400.0	7000.0	7844.4492	2256.5461	2414.0222
1450.0	7250.0	8124.6094	2481.4028	2665.6880

TABLE D-XXXVII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 5.00

TIME IN HOURS=		90.00	100.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
500.0	2500.0	2801.5898	336.6702	338.2332
550.0	2750.0	3081.7488	388.1096	390.5051
600.0	3000.0	3361.9080	443.5059	447.0432
650.0	3250.0	3642.0669	503.3738	508.4368
700.0	3500.0	3922.2258	568.3147	575.3713
750.0	3750.0	4202.3828	639.0203	648.6326
800.0	4000.0	4482.5430	716.2769	729.1121
850.0	4250.0	4762.6992	800.9561	817.7966
900.0	4500.0	5042.8594	894.0330	915.7883
950.0	4750.0	5323.0195	996.5693	1024.2871
1000.0	5000.0	5603.1797	1109.7349	1144.6135
1050.0	5250.0	5883.3359	1234.7910	1278.1907
1100.0	5500.0	6163.4961	1373.1052	1426.5613
1150.0	5750.0	6443.6562	1526.1541	1591.3896
1200.0	6000.0	6723.8125	1695.5178	1774.4570
1250.0	6250.0	7003.9727	1882.8730	1977.6526
1300.0	6500.0	7284.1328	2090.0400	2203.0273
1350.0	6750.0	7564.2891	2318.8938	2452.6934
1400.0	7000.0	7844.4492	2571.4993	2728.9756
1450.0	7250.0	8124.6094	2849.9746	3034.2600

TABLE D-XXXVIII

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS=		17.00		20.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	32.6590	32.6592
75.0	750.0	774.9585	56.6349	56.6364
100.0	1000.0	1033.2781	83.7026	83.7080
125.0	1250.0	1291.5974	113.3364	113.3510
150.0	1500.0	1549.9170	145.1998	145.2329
175.0	1750.0	1808.2366	179.0588	179.1248
200.0	2000.0	2066.5562	214.7428	214.8627
225.0	2250.0	2324.8755	252.1242	252.3275
250.0	2500.0	2583.1951	291.1069	291.4329
275.0	2750.0	2841.5146	331.6201	332.1196
300.0	3000.0	3099.8342	373.6101	374.3479
325.0	3250.0	3358.1536	417.0417	418.0977
350.0	3500.0	3616.4731	461.8921	463.3638
375.0	3750.0	3874.7927	508.1533	510.1580
400.0	4000.0	4133.1094	555.8237	558.5005
425.0	4250.0	4391.4297	604.9194	608.4316
450.0	4500.0	4649.7500	655.4592	659.9963
475.0	4750.0	4908.0703	707.4771	713.2578
500.0	5000.0	5166.3867	761.0090	768.2830
525.0	5250.0	5424.7070	816.1084	825.1594

TABLE D-XXXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS=			30.00	40.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	32.6600	32.6608
75.0	750.0	774.9585	56.6413	56.6462
100.0	1000.0	1033.2781	83.7259	83.7438
125.0	1250.0	1291.5974	113.3997	113.4484
150.0	1500.0	1549.9170	145.3431	145.4533
175.0	1750.0	1808.2366	179.3446	179.5644
200.0	2000.0	2066.5562	215.2626	215.6624
225.0	2250.0	2324.8755	253.0052	253.6829
250.0	2500.0	2583.1951	292.5193	293.6060
275.0	2750.0	2841.5146	333.7849	335.4502
300.0	3000.0	3099.8342	376.8069	379.2661
325.0	3250.0	3358.1536	421.6174	425.1370
350.0	3500.0	3616.4731	468.2693	473.1748
375.0	3750.0	3874.7927	516.8403	523.5227
400.0	4000.0	4133.1094	567.4231	576.3457
425.0	4250.0	4391.4297	620.1389	631.8459
450.0	4500.0	4649.7500	675.1199	690.2437
475.0	4750.0	4908.0703	732.5266	751.7957
500.0	5000.0	5166.3867	792.5295	816.7761
525.0	5250.0	5424.7070	855.3296	885.5000

TABLE D-XXXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS= 50.00 60.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	32.6616	32.6624
75.0	750.0	774.9585	56.6512	56.6561
100.0	1000.0	1033.2781	83.7617	83.7797
125.0	1250.0	1291.5974	113.4971	113.5458
150.0	1500.0	1549.9170	145.5635	145.6737
175.0	1750.0	1808.2366	179.7843	180.0041
200.0	2000.0	2066.5562	216.0623	216.4621
225.0	2250.0	2324.8755	254.3607	255.0384
250.0	2500.0	2583.1951	294.6924	295.7791
275.0	2750.0	2841.5146	337.1155	338.7808
300.0	3000.0	3099.8342	381.7251	384.1843
325.0	3250.0	3358.1536	428.6567	432.1765
350.0	3500.0	3616.4731	478.0806	482.9861
375.0	3750.0	3874.7927	530.2051	536.8875
400.0	4000.0	4133.1094	585.2686	594.1912
425.0	4250.0	4391.4297	643.5532	655.2603
450.0	4500.0	4649.7500	705.3672	720.4910
475.0	4750.0	4908.0703	771.0645	790.3335
500.0	5000.0	5166.3867	841.0227	865.2693
525.0	5250.0	5424.7070	915.6702	945.8406

TABLE D-XXXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN (TIME IN HOURS= 70.00)	DYNAMIC STRAIN MICROIN/IN (TIME IN HOURS= 80.00)
50.0	500.0	516.6389	32.6632	32.6640
75.0	750.0	774.9585	56.6611	56.6660
100.0	1000.0	1033.2781	83.7976	83.8155
125.0	1250.0	1291.5974	113.5945	113.6432
150.0	1500.0	1549.9170	145.7839	145.8940
175.0	1750.0	1808.2366	180.2239	180.4438
200.0	2000.0	2066.5562	216.8619	217.2618
225.0	2250.0	2324.8755	255.7161	256.3938
250.0	2500.0	2583.1951	296.8655	297.9519
275.0	2750.0	2841.5146	340.4460	342.1113
300.0	3000.0	3099.8342	386.6433	389.1025
325.0	3250.0	3358.1536	435.6960	439.2158
350.0	3500.0	3616.4731	487.8916	492.7971
375.0	3750.0	3874.7927	543.5698	550.2522
400.0	4000.0	4133.1094	603.1138	612.0364
425.0	4250.0	4391.4297	666.9675	678.6746
450.0	4500.0	4649.7500	735.6145	750.7383
475.0	4750.0	4908.0703	809.6023	828.8711
500.0	5000.0	5166.3867	889.5159	913.7625
525.0	5250.0	5424.7070	976.0107	1006.1809

TABLE D-XXXVIII (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 10.00

TIME IN HOURS=		90.00	100.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	500.0	516.6389	32.6648	32.6656
75.0	750.0	774.9585	56.6709	56.6759
100.0	1000.0	1033.2781	83.8334	83.8513
125.0	1250.0	1291.5974	113.6918	113.7405
150.0	1500.0	1549.9170	146.0042	146.1144
175.0	1750.0	1808.2366	180.6636	180.8834
200.0	2000.0	2066.5562	217.6616	218.0615
225.0	2250.0	2324.8755	257.0713	257.7490
250.0	2500.0	2583.1951	299.0386	300.1250
275.0	2750.0	2841.5146	343.7764	345.4417
300.0	3000.0	3099.8342	391.5615	394.0205
325.0	3250.0	3358.1536	442.7356	446.2551
350.0	3500.0	3616.4731	497.7029	502.6084
375.0	3750.0	3874.7927	556.9346	563.6169
400.0	4000.0	4133.1094	620.9592	629.8818
425.0	4250.0	4391.4297	690.3818	702.0891
450.0	4500.0	4649.7500	765.8618	780.9856
475.0	4750.0	4908.0703	848.1401	867.4089
500.0	5000.0	5166.3867	938.0090	962.2556
525.0	5250.0	5424.7070	1036.3513	1066.5215

TABLE D-XXXIX

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS=		17.00	20.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	266.7317	266.9763
55.0	2750.0	2665.1794	303.8022	304.1772
60.0	3000.0	2907.4685	342.2021	342.7559
65.0	3250.0	3149.7576	381.8923	382.6848
70.0	3500.0	3392.0466	422.8452	423.9497
75.0	3750.0	3634.3357	465.0464	466.5508
80.0	4000.0	3876.6248	508.4861	510.4949
85.0	4250.0	4118.9102	553.1667	555.8027
90.0	4500.0	4361.1992	599.1003	602.5054
95.0	4750.0	4603.4883	646.3015	650.6399
100.0	5000.0	4845.7773	694.7969	700.2561
105.0	5250.0	5088.0664	744.6165	751.4092
110.0	5500.0	5330.3555	795.7983	804.1653
115.0	5750.0	5572.6445	848.3901	858.6008
120.0	6000.0	5814.9336	902.4404	914.7961
125.0	6250.0	6057.2227	958.0083	972.8433
130.0	6500.0	6299.5117	1015.1572	1032.8418
135.0	6750.0	6541.8008	1073.9565	1094.8989
140.0	7000.0	6784.0898	1134.4849	1159.1326
145.0	7250.0	7026.3789	1196.8242	1225.6680

TABLE D-XXXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS= 30.00 40.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	267.7917	268.6072
55.0	2750.0	2665.1794	305.4270	306.6768
60.0	3000.0	2907.4685	344.6013	346.4470
65.0	3250.0	3149.7576	385.3264	387.9680
70.0	3500.0	3392.0466	427.6313	431.3130
75.0	3750.0	3634.3357	471.5659	476.5811
80.0	4000.0	3876.6248	517.1914	523.8877
85.0	4250.0	4118.9102	564.5889	573.3752
90.0	4500.0	4361.1992	613.8557	625.2063
95.0	4750.0	4603.4883	665.1011	679.5625
100.0	5000.0	4845.7773	718.4534	736.6506
105.0	5250.0	5088.0664	774.0520	796.6948
110.0	5500.0	5330.3555	832.0549	859.9448
115.0	5750.0	5572.6445	892.6362	926.6716
120.0	6000.0	5814.9336	955.9812	997.1663
125.0	6250.0	6057.2227	1022.2927	1071.7422
130.0	6500.0	6299.5117	1091.7898	1150.7380
135.0	6750.0	6541.8008	1164.7063	1234.5137
140.0	7000.0	6784.0898	1241.2917	1323.4509
145.0	7250.0	7026.3789	1321.8142	1417.9602

TABLE D-XXXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS= 50.00 60.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	269.4226	270.2380
55.0	2750.0	2665.1794	307.9265	309.1763
60.0	3000.0	2907.4685	348.2925	350.1379
65.0	3250.0	3149.7576	390.6094	393.2510
70.0	3500.0	3392.0466	434.9946	438.6763
75.0	3750.0	3634.3357	481.5962	486.6113
80.0	4000.0	3876.6248	530.5842	537.2808
85.0	4250.0	4118.9102	582.1614	590.9475
90.0	4500.0	4361.1992	636.5566	647.9072
95.0	4750.0	4603.4883	694.0237	708.4851
100.0	5000.0	4845.7773	754.8479	773.0452
105.0	5250.0	5088.0664	819.3374	841.9802
110.0	5500.0	5330.3555	887.8345	915.7244
115.0	5750.0	5572.6445	960.7070	994.7424
120.0	6000.0	5814.9336	1038.3513	1079.5364
125.0	6250.0	6057.2227	1121.1917	1170.6414
130.0	6500.0	6299.5117	1209.6860	1268.6340
135.0	6750.0	6541.8008	1304.3210	1374.1284
140.0	7000.0	6784.0898	1405.6101	1487.7693
145.0	7250.0	7026.3789	1514.1064	1610.2524

TABLE D-XXXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS=		70.00		80.00
STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	271.0535	271.8689
55.0	2750.0	2665.1794	310.4260	311.6758
60.0	3000.0	2907.4685	351.9836	353.8291
65.0	3250.0	3149.7576	395.8926	398.5339
70.0	3500.0	3392.0466	442.3579	446.0396
75.0	3750.0	3634.3357	491.6265	496.6414
80.0	4000.0	3876.6248	543.9771	550.6736
85.0	4250.0	4118.9102	599.7339	608.5200
90.0	4500.0	4361.1992	659.2576	670.6079
95.0	4750.0	4603.4883	722.9463	737.4075
100.0	5000.0	4845.7773	791.2424	809.4397
105.0	5250.0	5088.0664	864.6230	887.2656
110.0	5500.0	5330.3555	943.6140	971.5037
115.0	5750.0	5572.6445	1028.7778	1062.8130
120.0	6000.0	5814.9336	1120.7214	1161.9062
125.0	6250.0	6057.2227	1220.0908	1269.5400
130.0	6500.0	6299.5117	1327.5823	1386.5300
135.0	6750.0	6541.8008	1443.9358	1513.7429
140.0	7000.0	6784.0898	1569.9282	1652.0872
145.0	7250.0	7026.3789	1706.3987	1802.5444

TABLE D-XXXIX (Cont.)

ALTERNATING STRESS / STATIC STRESS =A= 50.00

TIME IN HOURS=	90.00	100.00

STATIC STRESS PSI	ALTERNATING STRESS PSI	EQUIVALENT STRESS PSI	DYNAMIC STRAIN MICROIN/IN	DYNAMIC STRAIN MICROIN/IN
50.0	2500.0	2422.8904	272.6843	273.4998
55.0	2750.0	2665.1794	312.9255	314.1753
60.0	3000.0	2907.4685	355.6746	357.5203
65.0	3250.0	3149.7576	401.1755	403.8171
70.0	3500.0	3392.0466	449.7212	453.4028
75.0	3750.0	3634.3357	501.6565	506.6716
80.0	4000.0	3876.6248	557.3701	564.0664
85.0	4250.0	4118.9102	617.3062	626.0925
90.0	4500.0	4361.1992	681.9585	693.3088
95.0	4750.0	4603.4883	751.8689	766.3301
100.0	5000.0	4845.7773	827.6370	845.8342
105.0	5250.0	5088.0664	909.9084	932.5510
110.0	5500.0	5330.3555	999.3936	1027.2832
115.0	5750.0	5572.6445	1096.8486	1130.8840
120.0	6000.0	5814.9336	1203.0916	1244.2766
125.0	6250.0	6057.2227	1318.9897	1368.4392
130.0	6500.0	6299.5117	1445.4783	1504.4263
135.0	6750.0	6541.8008	1583.5505	1653.3577
140.0	7000.0	6784.0898	1734.2466	1816.4055
145.0	7250.0	7026.3789	1898.6909	1994.8367

APPENDIX E

THE ELECTRICAL ANALOG

In presenting the behavior of a linear viscoelastic material, the use of mechanical models with linearly combined constants is well established. However, complex models are required to obtain a close approximation to the behavior of real materials, and the equations governing their response are difficult to manipulate.

The solutions of mechanical models can be obtained by inspection in cases where the solution to analogous electrical network already exists. The analogy between the electrical and mechanical systems extends even further. In an electrical circuit, energy may be stored as magnetic or electrical energy, and in addition may be converted to heat in the dissipative elements, corresponding to the three circuit elements of inductance, capacitance and resistance, respectively. Similarly, in a mechanical system energy may be stored in its kinetic and potential forms, and may also be dissipated in the frictional elements. The three corresponding mechanical parameters are the mass, the elastic content, and the viscous element.

The concept of impedance is basic in the electrical-mechanical analogy. The impedance of an electrical network denoted by $\overset{*}{Z}(j\omega)$, which relates voltage to current and hence defines the response of the system to any kind of driving

function. It is a complex number whose magnitudes and phase change with frequency. At any given frequency, its magnitude is the ratio of the amplitudes of the electromotive force and current. The concept is very similar to the idea of the complex modulus which defines the response of a viscoelastic material. Since the response of a viscoelastic body may be represented by that of a mechanical model, the complex modulus may be referred to as the mechanical impedance of the body. Table (E-I) shows the analogous relationships between the electrical networks and the mechanical models.

Papazian (20) showed that the electrical analog can be used to simplify the representation of the behavior of a viscoelastic material. He considered an electrical network, Figure (E-I), to be made up of n + 2 parallel branches, n of which have a resistance R and a capacitance C in series, while the other two have a single resistance R_o and a capacitance C_o. The impedance of a single resistance is R and that of a capacitance is $1/j\omega C$. The total impedance of the network is:

$$Z(j\omega) = \frac{1}{\frac{1}{R_1 + \frac{1}{j\omega C_1}} + \frac{1}{R_2 + \frac{1}{j\omega C_2}} + \ldots + \frac{1}{R_n + \frac{1}{j\omega C_n}} + \frac{1}{\frac{1}{j\omega C_o}} + \frac{1}{R_o}} \qquad \text{(E-1)}$$

TABLE E-I. Electrical-Mechanical Analogy.

Mechanical System.		Electrical System.	
Stress	σ	Voltage	V
Strain	ε	Charge	q
Rate of Strain	$\dot{\varepsilon}$	Current	i
Elasticity	E	Elastance	Γ
Elastic Compliance	I / E	Capacitance	C = I
Viscosity	λ	Resistance	R
Mass	m	Inductance	L
Complex Elastic Modulus	$\overset{*}{E}(j\omega) = \frac{\overset{*}{\sigma}(j\omega)}{\overset{*}{\varepsilon}(j\omega)}$	Electric Impedance	$\overset{*}{Z}(j\omega) = \frac{\overset{*}{V}(j\omega)}{\overset{*}{q}(j\omega)}$
Stress, add in Parallel		Voltage, add in Series	
Rate of Strain, add in Series.		Current, add in Parallel.	

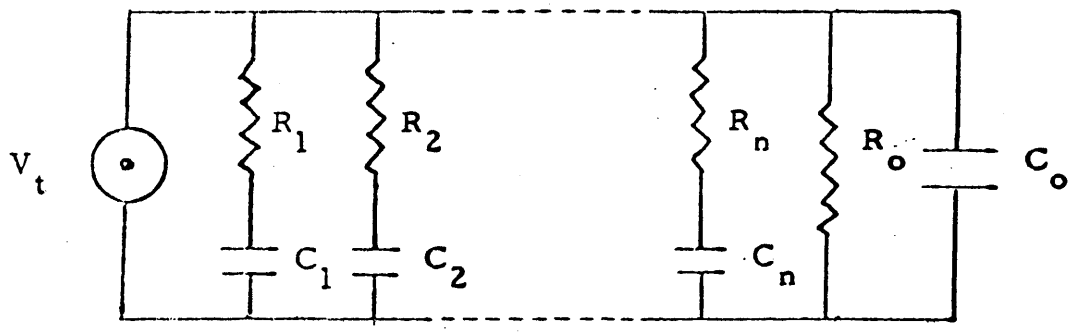

Figure E-1. An Electrical Network Analogous to a Mechanical Model

The electrical impedance relates voltage to charge with the following equation: $\overset{*}{Z}(j\omega) = \overset{*}{V}(j\omega)/\overset{*}{i}(j\omega)$, and the impedance which relates voltage to charge is:

$$\overset{*}{\bar{Z}}(j\omega) = \overset{*}{V}(j\omega)/\overset{*}{q}(j\omega).$$

Since $i(t) = \dot{q}(t)$

therefore, $\overset{*}{i}(j\omega) = \overset{*}{\dot{q}}(j\omega) = j\omega\overset{*}{q}(j\omega)$

and hence:

$$\bar{Z}(j\omega) = j\omega\overset{*}{Z}(j\omega).$$

The impedance of the network which relates the voltage to charge is therefore given by:

$$\overset{*}{\bar{Z}}(j\omega) = \frac{1}{\frac{1}{\frac{1}{C_1} + j\omega R_1} + \frac{1}{\frac{1}{C_2} + j\omega R_2} + \ldots + \frac{1}{\frac{1}{C_n} + j\omega R_n} + \frac{1}{j\omega R_o} + \frac{1}{\frac{1}{C_o}}} \qquad \text{(E-2)}$$

Translating this impedance of the mechanical model in accordance with Table (E-1), $\bar{Z}(j\omega)$ is replaced by $\overset{*}{E}(j\omega)$, $1/C_i$ by E_i and R_i by λ_i. The resulting equation of the impedance, for the analogous mechanical model shown in Figure 18 can be expressed as:

$$\overset{*}{E}(j\omega) = \frac{1}{\frac{1}{\frac{k_1\sigma_e t}{A_1} + \frac{j\omega\sigma_e t}{A_1}} + \frac{1}{\frac{k_2\sigma_e t}{A_2} + \frac{j\omega\sigma_e t}{A_2}} + \ldots + \frac{1}{\frac{k_n\sigma_e t}{A_n} + \frac{j\omega\sigma_e t}{A_n}} + \frac{1}{\frac{j\omega\sigma_e t}{\dot{\varepsilon}_{ss}} + \frac{\sigma_e t}{\varepsilon(0)}}} \qquad \text{(E-3)}$$

APPENDIX F

MECHANICAL MODEL REPRESENTING BEHAVIOR OF MORTAR

Sample Calculation at an Equivalent Static Stress of 3993 psi

Static Stress		= 3258 psi
Alternating Stress		= 978 psi
Equivalent Static Stress		= 3993 psi
Stress Ratio A		= 0.3
Initial Strain	$\varepsilon(0)$	= 420 (U in/in.)
Final Rate of Strain	$\dot{\varepsilon}_{ss}$	= 0.007 (U in/in./min)

Figure F-1 is a plot of dynamic strain versus time, while Figure F-2 is a plot of the rate of dynamic strain obtained from the previous curve by graphical integration. Figures F-3 and F-4 show the steps in the graphical approximation discussed in Chapter IV. It can be seen from Figures F-3 and F-4 that three approximations are required in this particular case. Thus, the equation representing the rate of dynamic strain is found to be:

$$\dot{\varepsilon}(t) = \left[6.2\, e^{-0.0076t} + 9.2\, e^{-0.0264t} + 65.0\, e^{-0.0868t} + 0.007 \right] 10^{-6} \qquad \text{(F-1)}$$

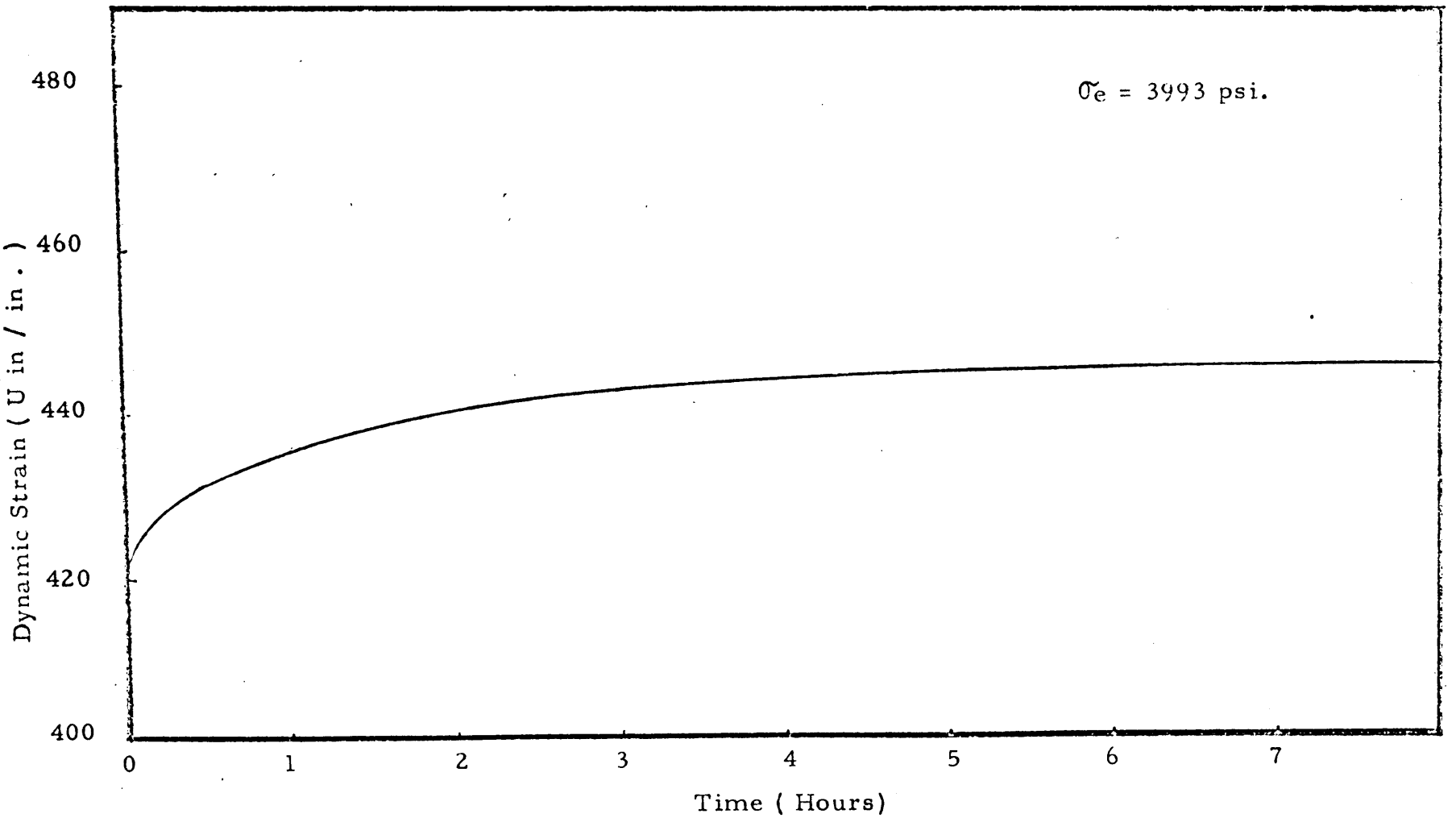

Figure F-1. Dynamic Strain vs. Time Plot of Mortar for an Equivalent Static Stress of 3993 psi.

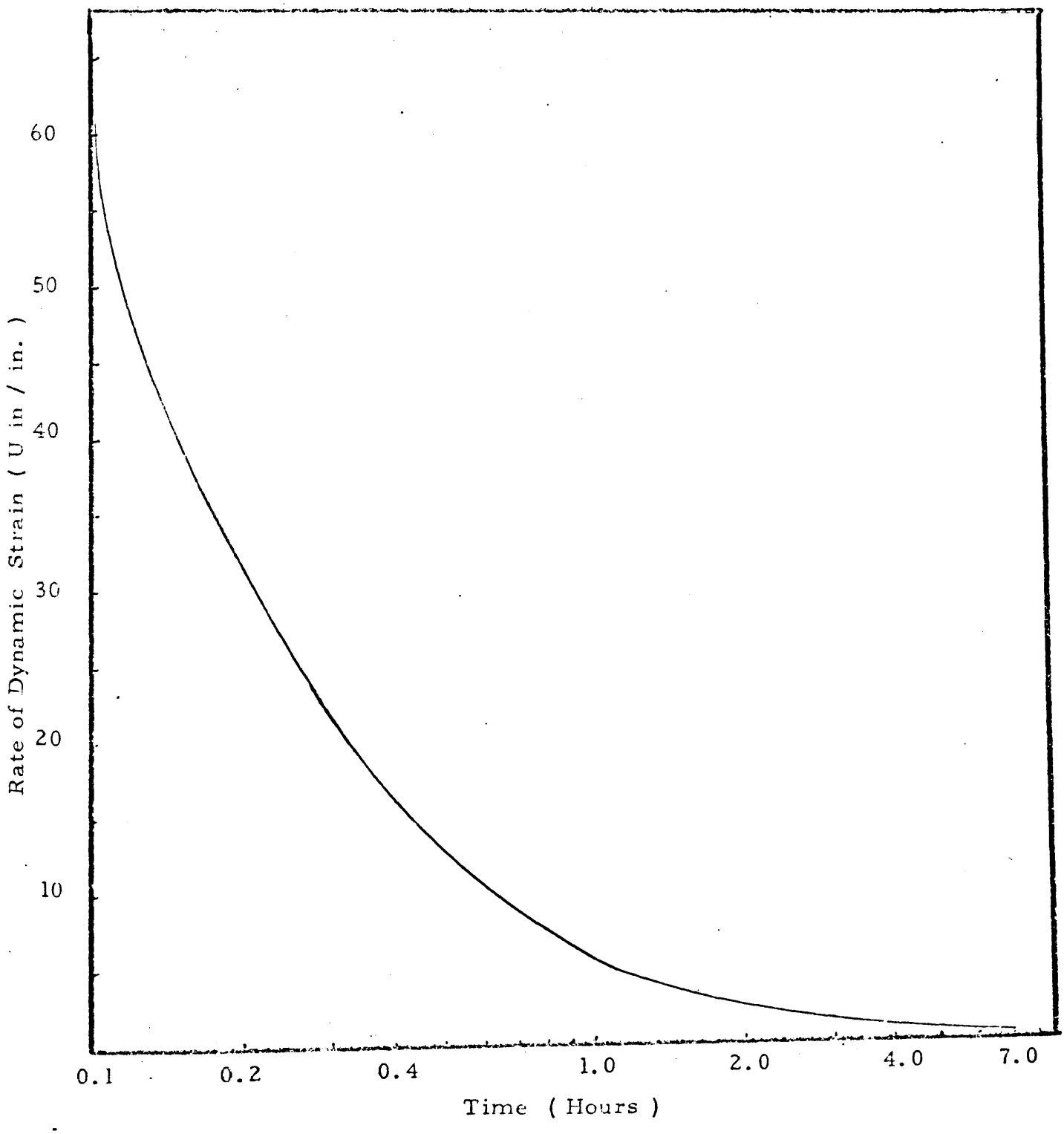

Figure F-2. Rate of Dynamic Strain vs. Time Plot for an Equivalent Static Stress of 3993 psi.

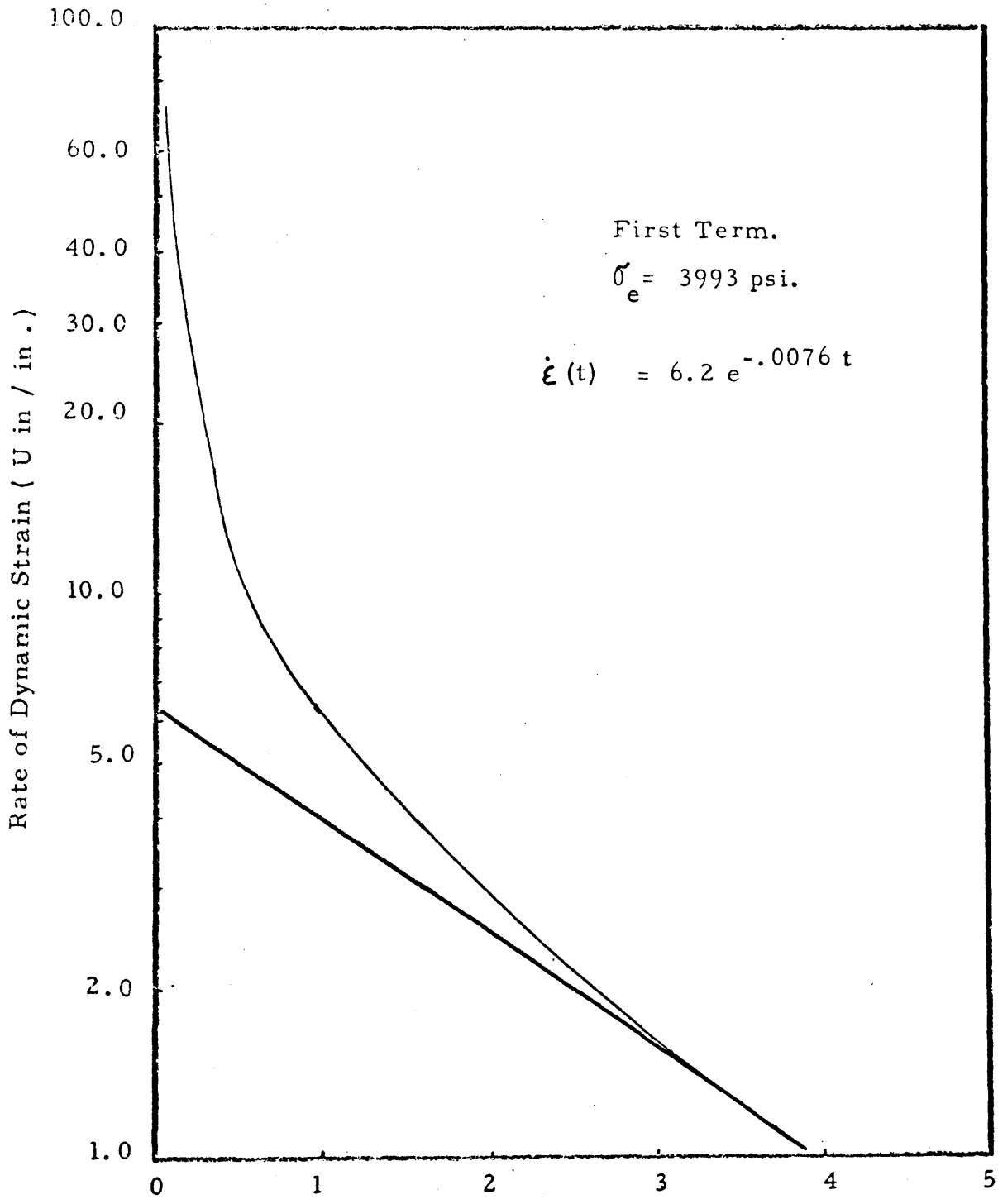

FIGURE F-3. Equivalent Static Stress Response ; Approximation for First Term.

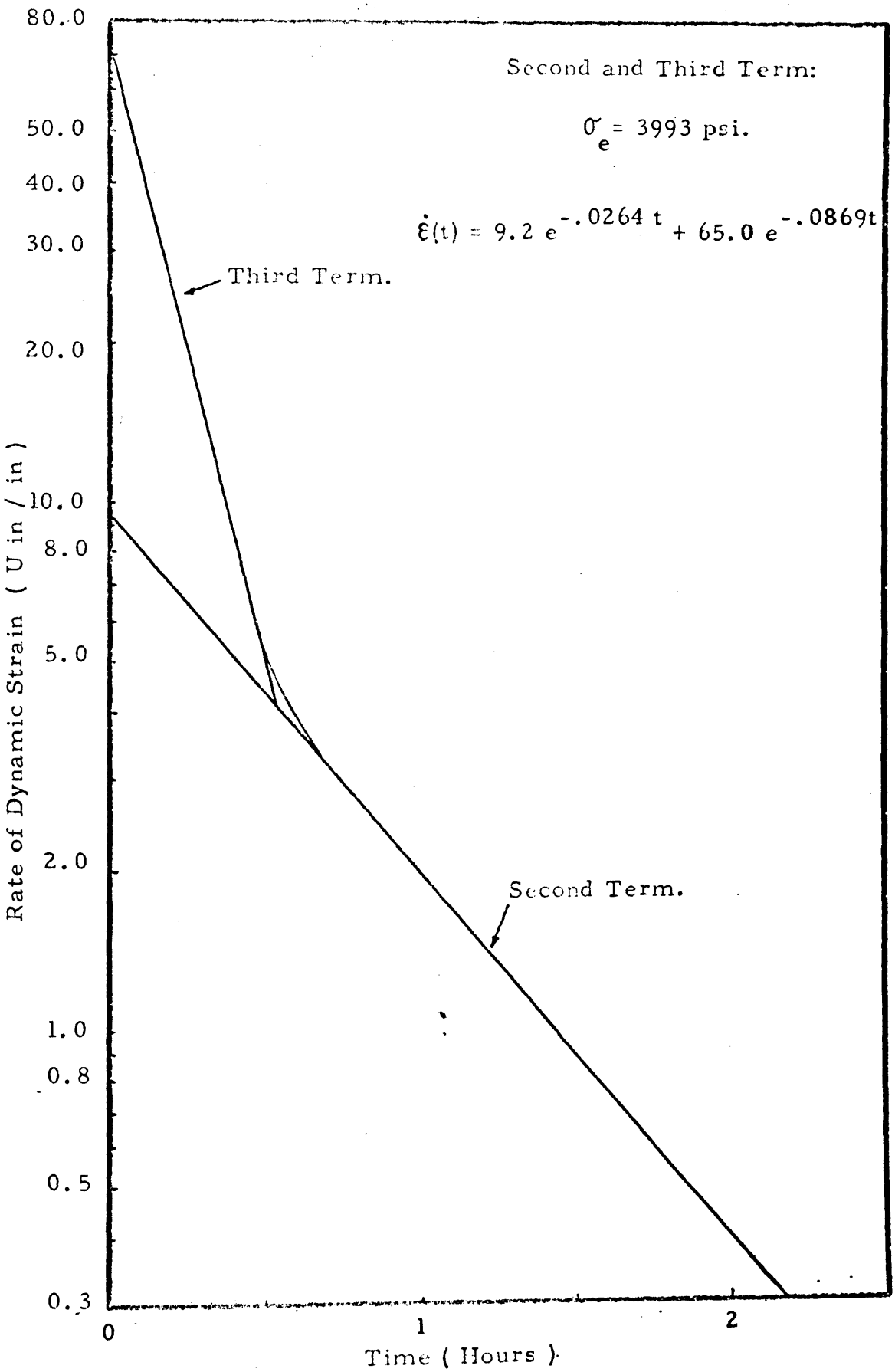

FIGURE F-4. Equivalent Static Stress Response; Approximation for Second and Third Terms.

Using equation (19) we get:

$$\varepsilon(j\omega) = \left[\frac{6.2}{0.0076 + j\omega} + \frac{9.2}{0.0264 + j\omega} + \frac{65.0}{0.0869 + j\omega} + \frac{0.007}{j\omega} \right] 10^{-6} \qquad \text{(F-2)}$$

Using equations (20) and (21) the complex elastic modulus can be expressed as:

$$\overset{*}{E}(j\omega) = \frac{3993 \times 10^6}{\frac{6.2}{0.0076+j\omega} + \frac{9.2}{0.0264+j\omega} + \frac{65.0}{0.0869+j\omega} + \frac{0.007}{j\omega} + 420} \qquad \text{(F-3)}$$

or

$$\overset{*}{E}(j\omega) = \frac{10^6}{\frac{1}{(4.89+644.03j\omega)} + \frac{1}{(11.45+434.02j\omega)} + \frac{1}{(5.33+61.46j\omega)}}$$

$$\frac{10^6}{+ \frac{1}{570 \times 10^3 j\omega} + \frac{1}{9.507}} \qquad \text{(F-4)}$$

According to the concepts developed in Chapter IV this analysis shows that the dynamic creep behavior of mortar at an equivalent static stress of 3,993 psi can be expressed by a mechanical model consisting of three Kelvin units connected in series with one Maxwell unit. The values of all the parameters of the model Figure F-5 can be read from Equation F-4.

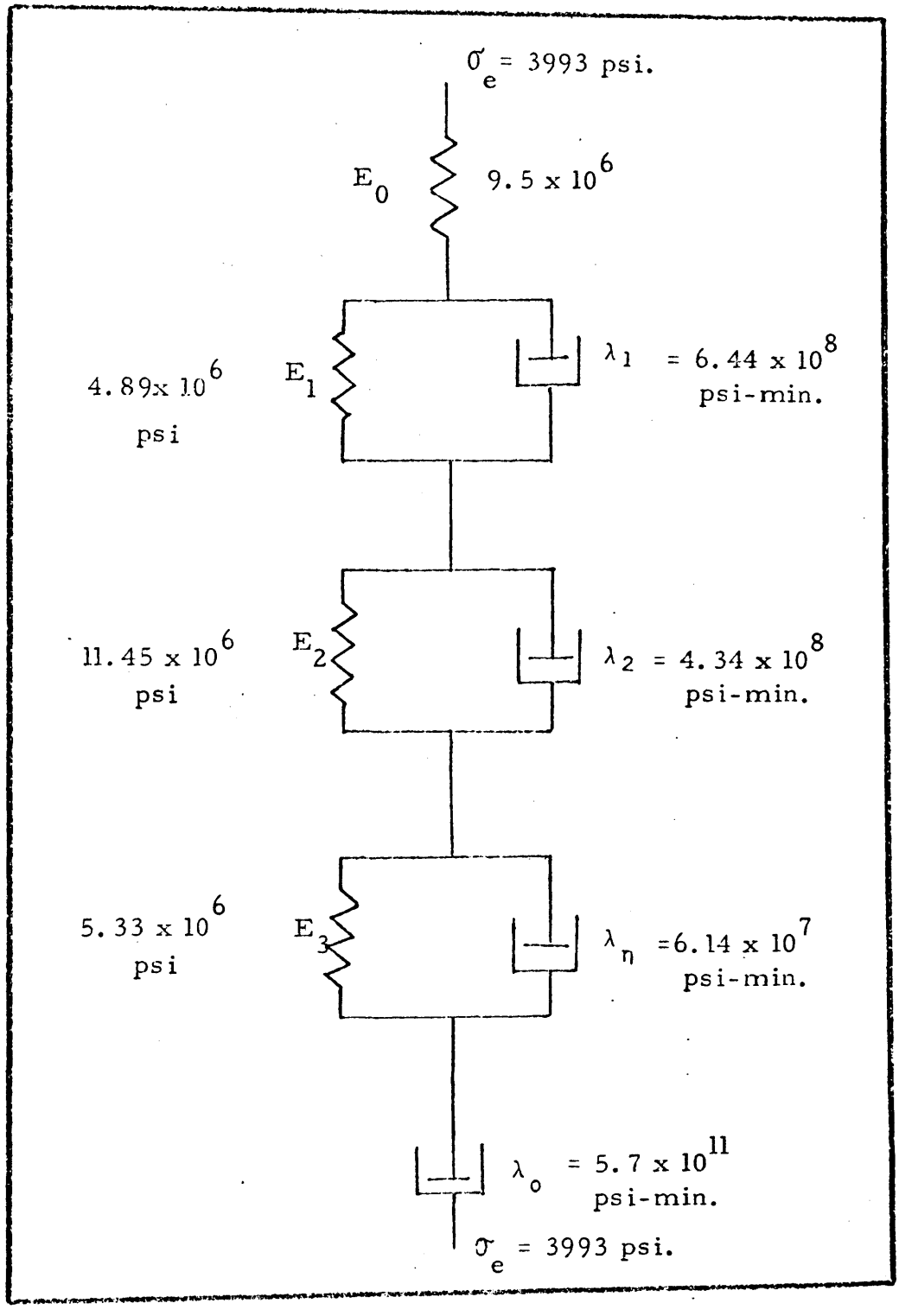

FIGURE F-5. Model Representation of the Response of Mortar under an Equivalent Static Stress of 3993 psi.

APPENDIX G

EXPERIMENTAL DATA

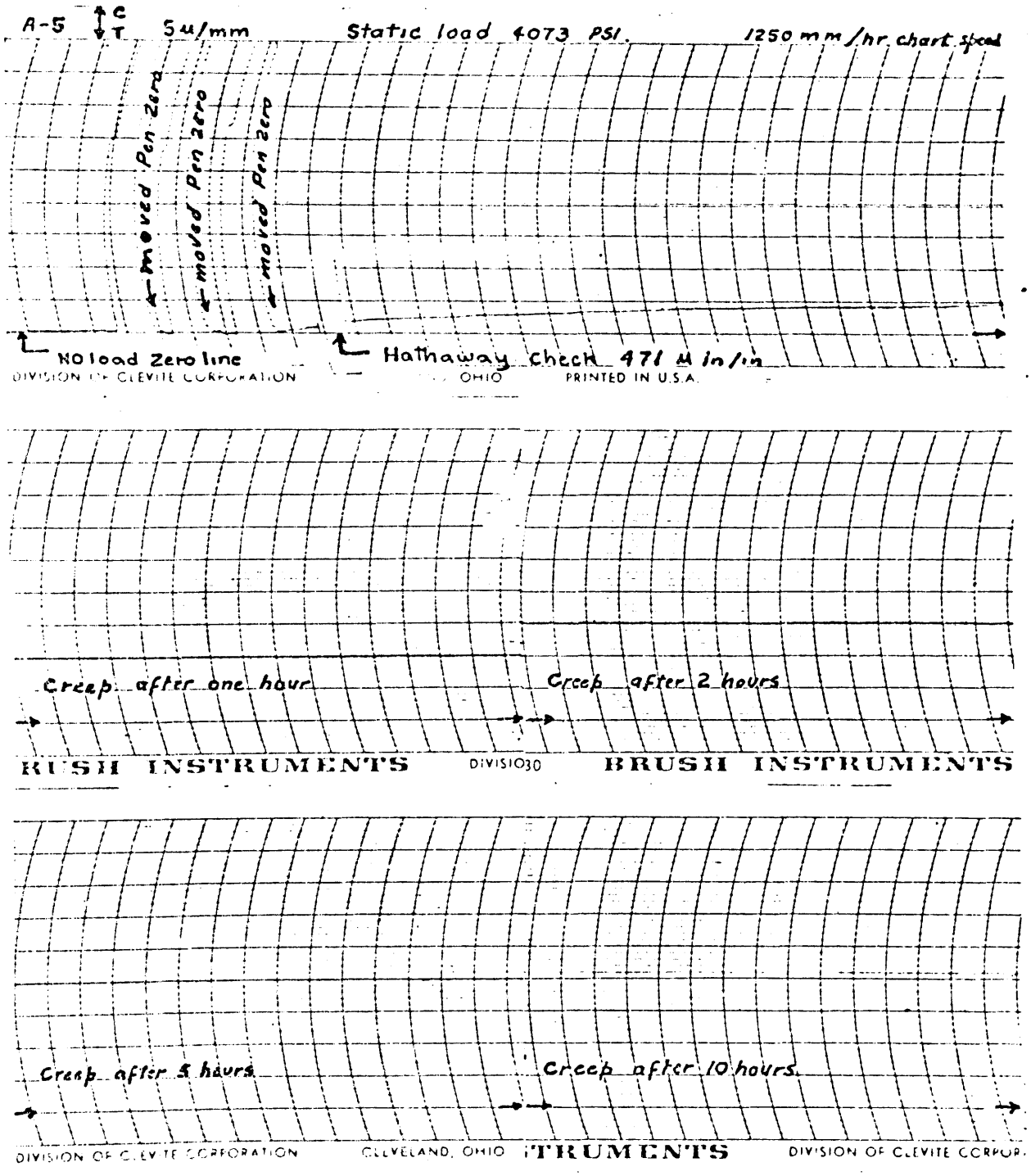

Figure G-1. Creep of Mortar under a Static Load. An example of the Experiment Used in Design Data Diagrams.

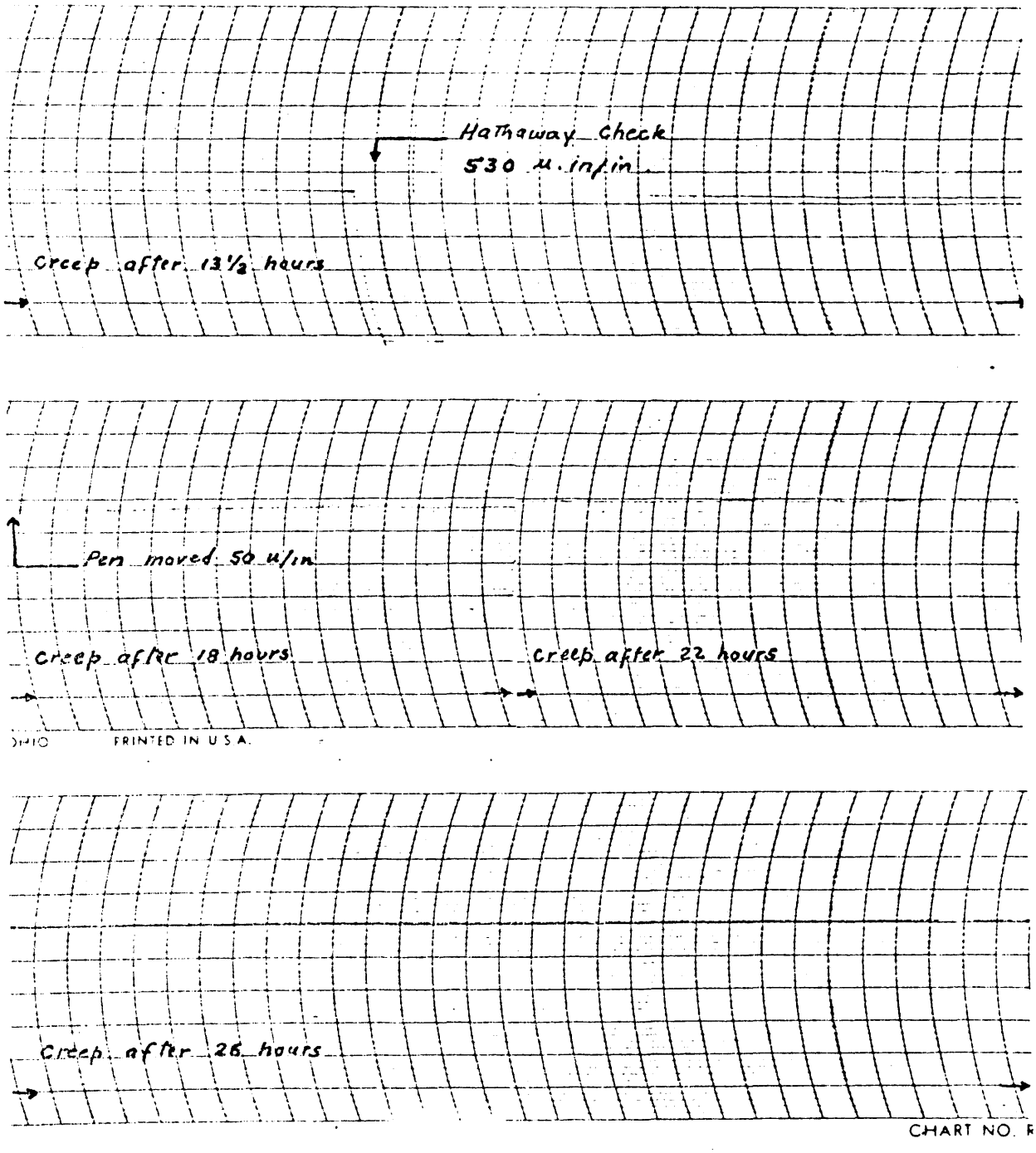

Figure G-1 (Cont'd:)

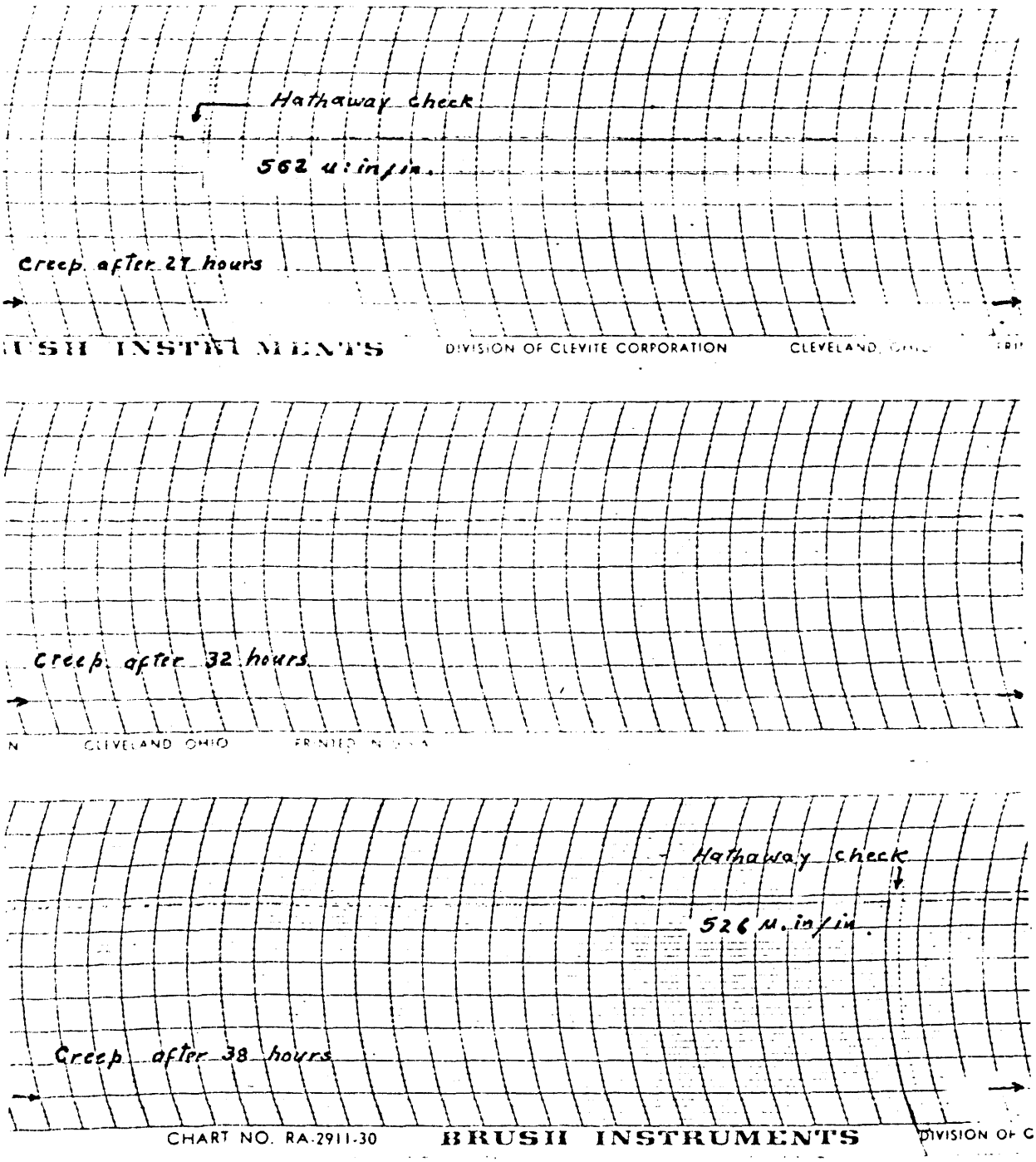

Figure G-1 (Contd:),

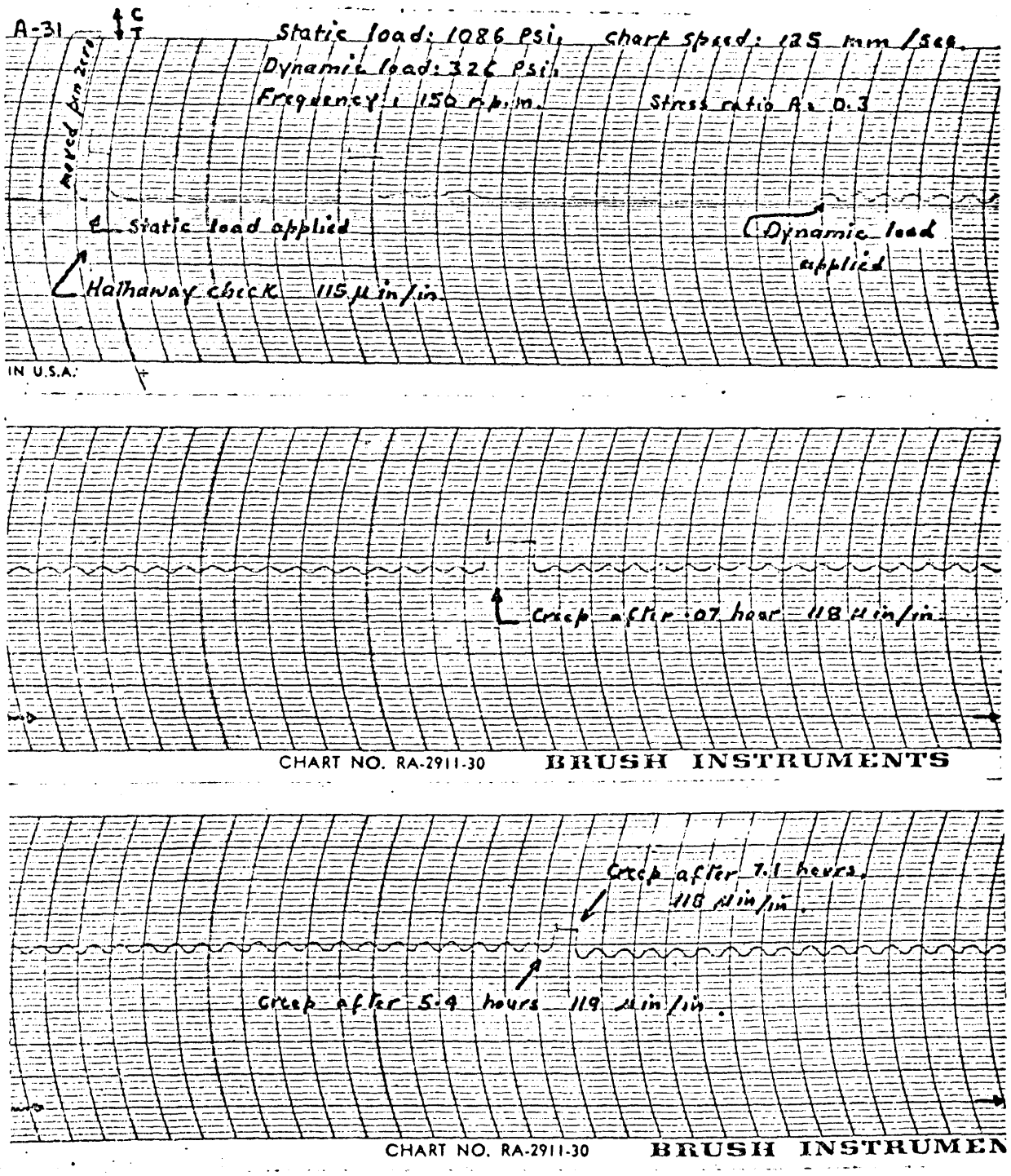

Figure G- 2. The Dynamic Creep of Mortar under a Combined Static and Dynamic Stress with a Stress Ratio A = 0.3

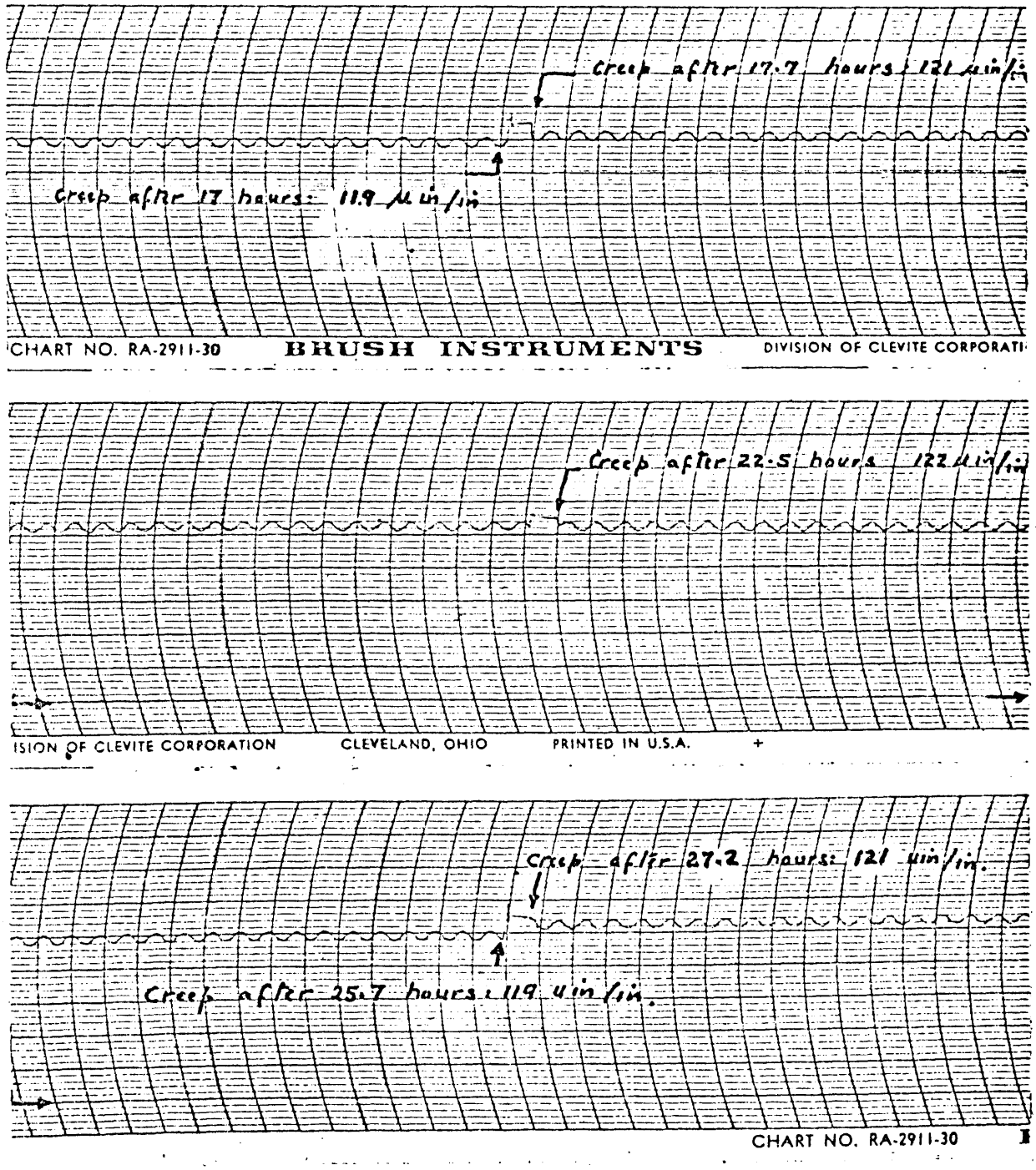

Figure G-2 (Contd:)

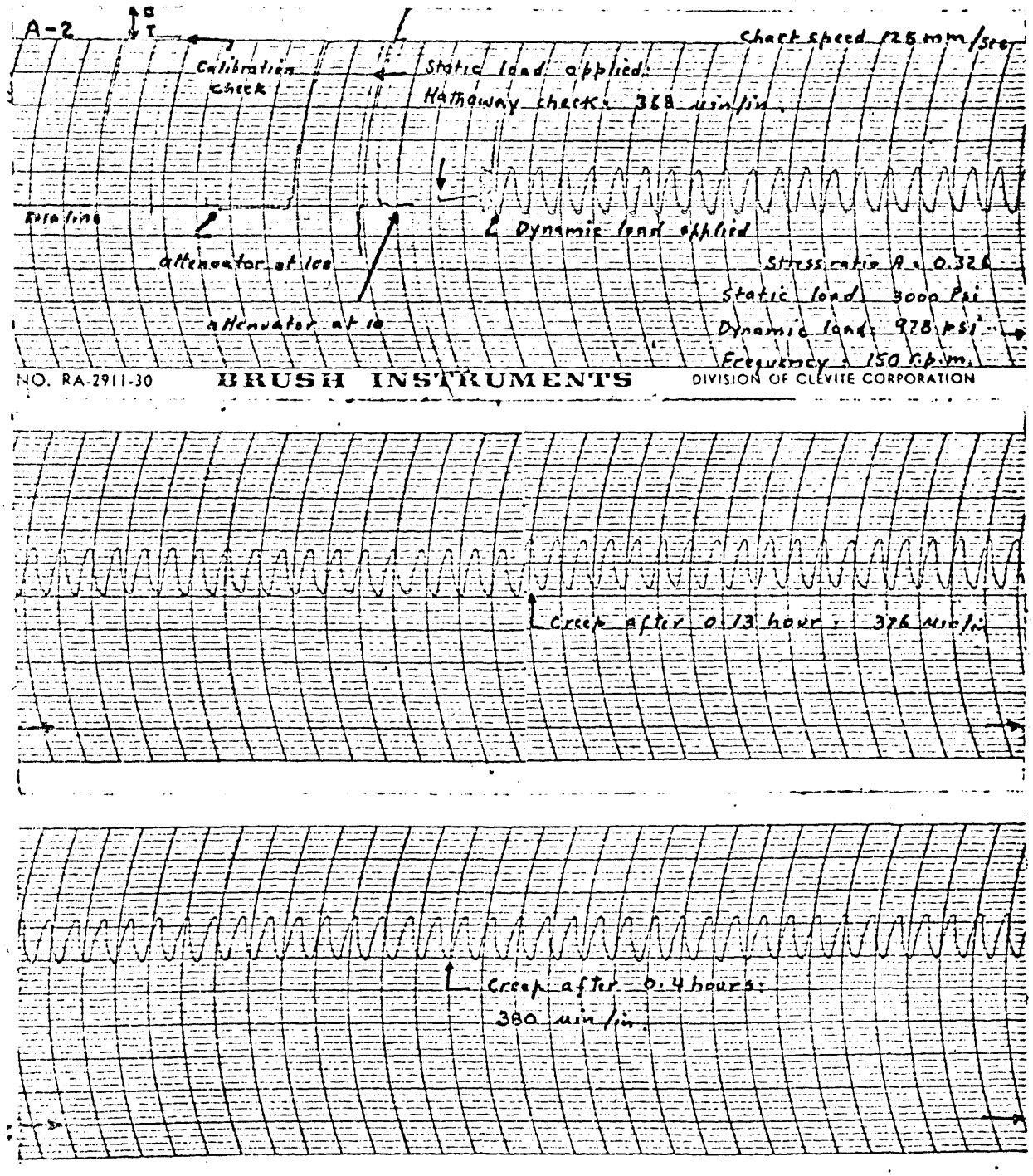

Figure G-3. The Dynamic Creep of Mortar under a Combined Static and Dynamic Stress with a Stress Ratio A =0.326

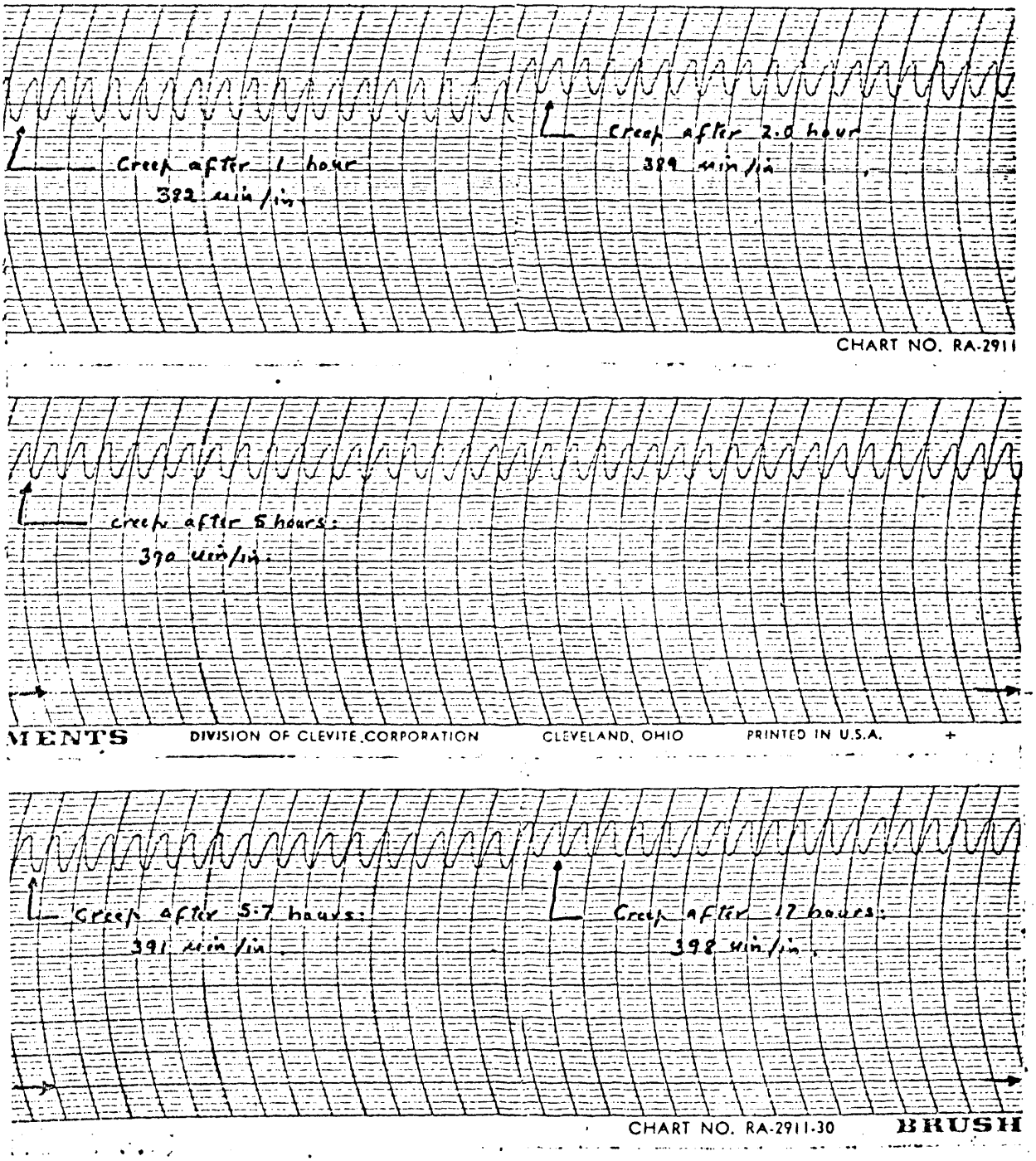

Figure G-3. (Contd:)

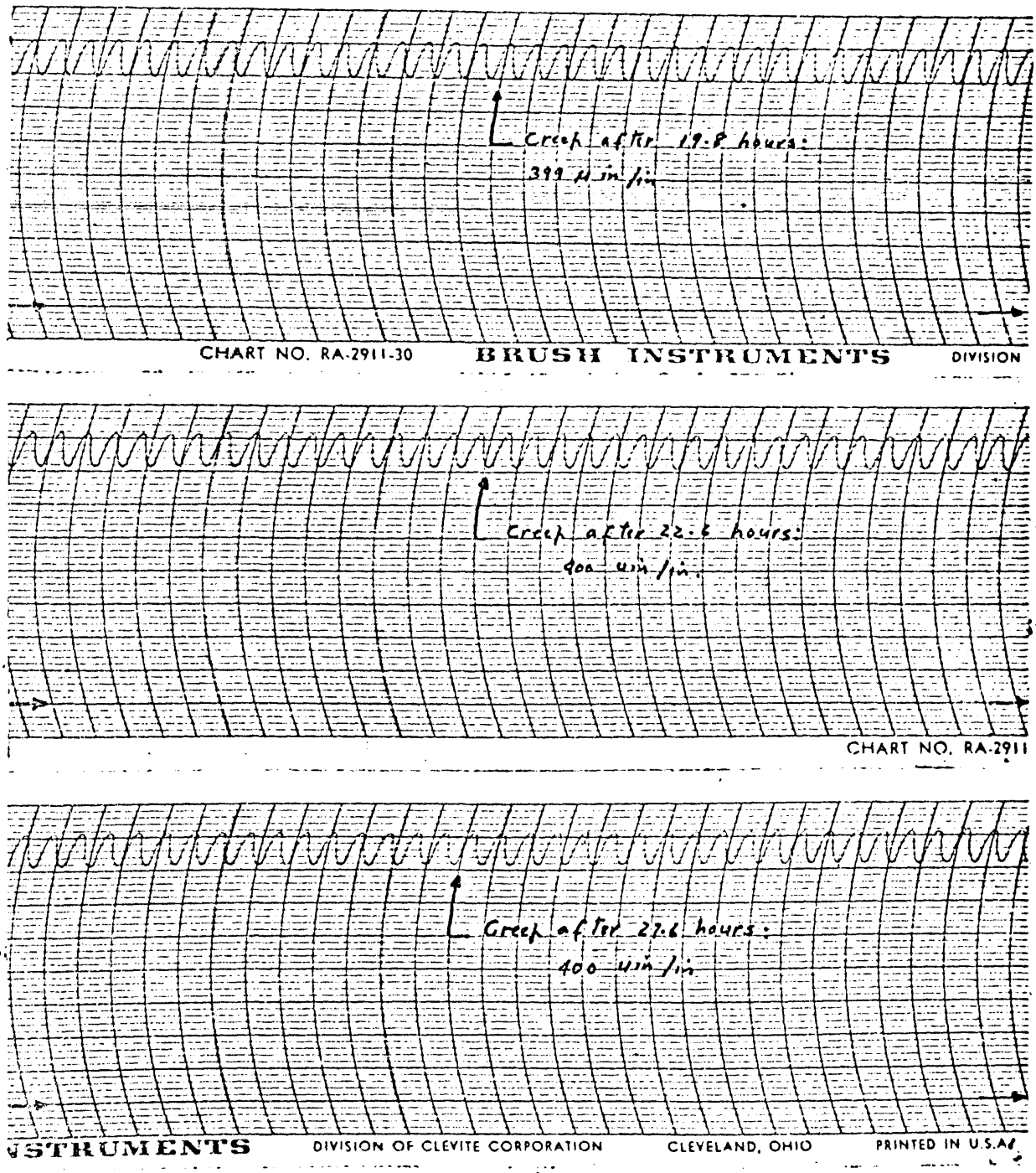

Figure G-3. (Contd:)

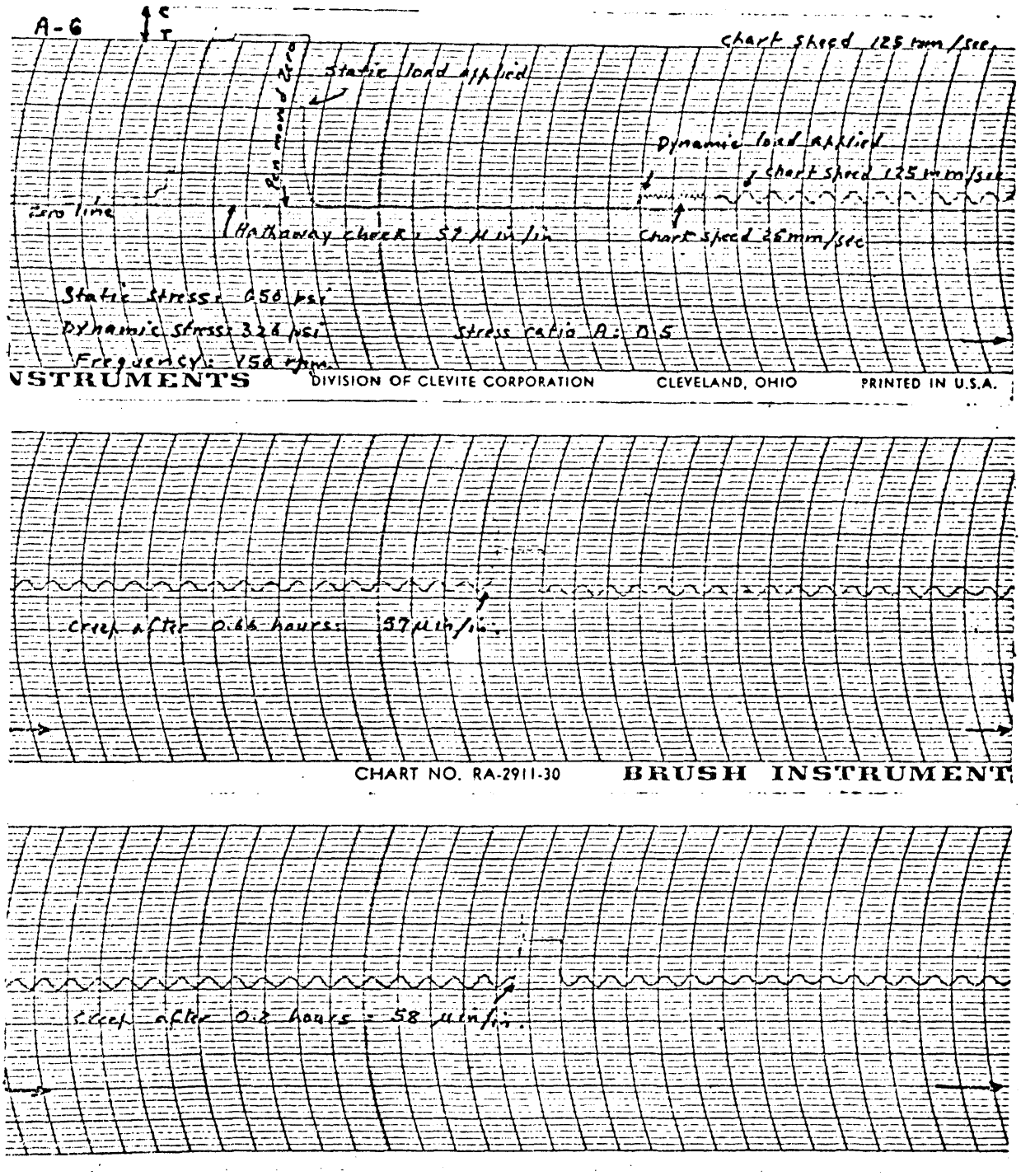

Figure G-4. The Dynamic Creep of Mortar under a Combined Static and Dynamic Stress with a Stress Ratio A = 0.5

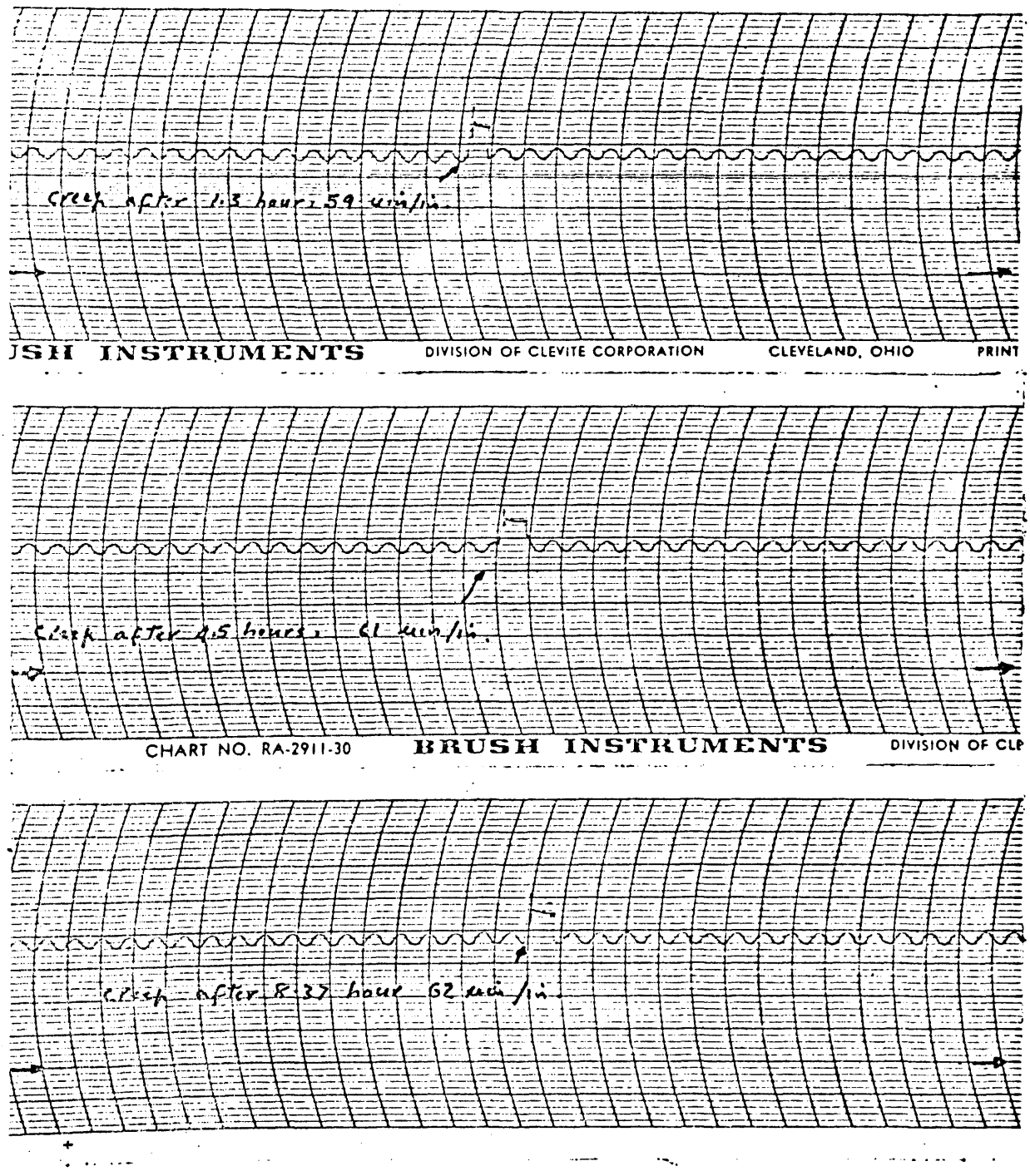

Figure G-4. (Contd:)

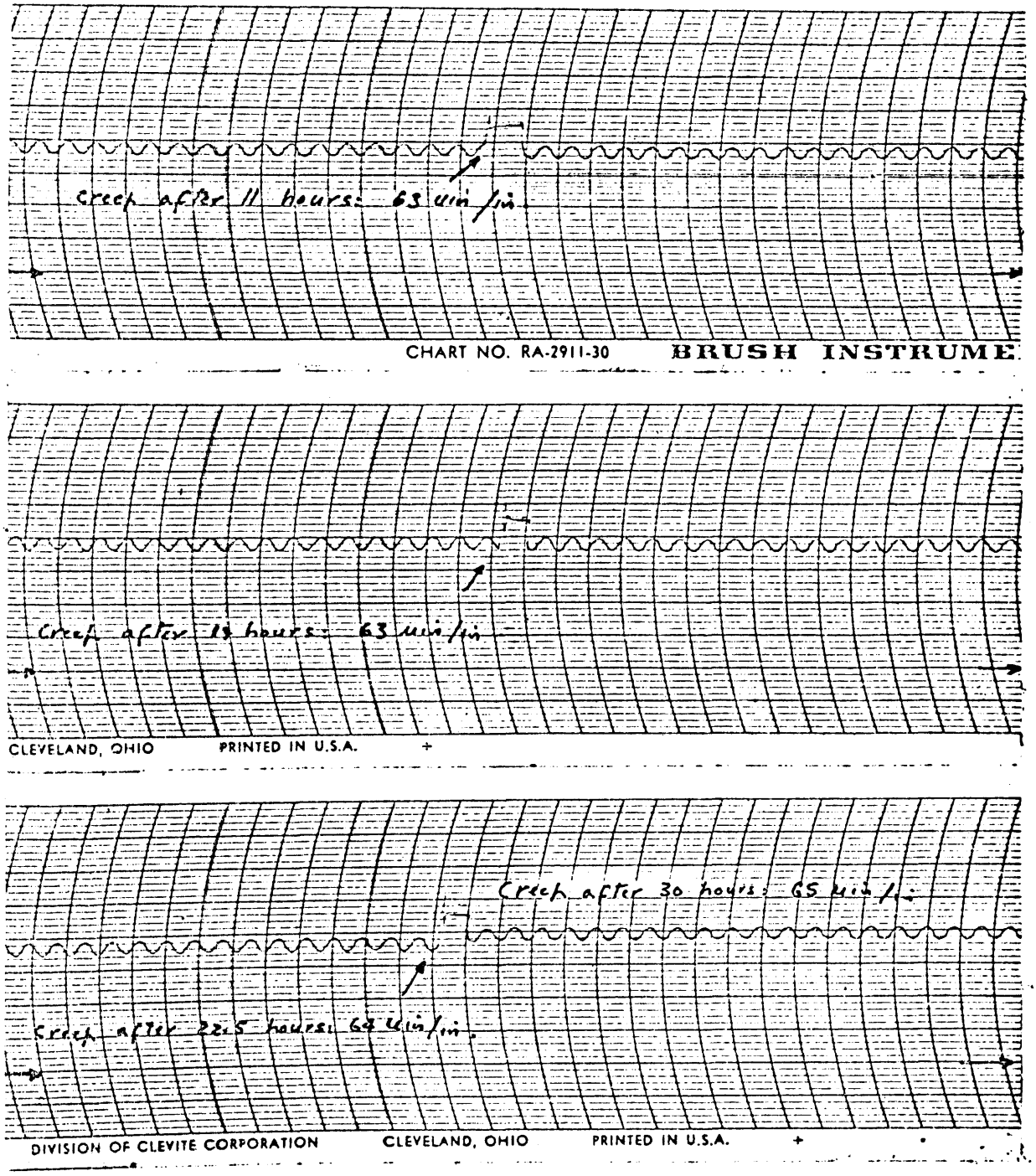

Figure G-4 (Contd:)

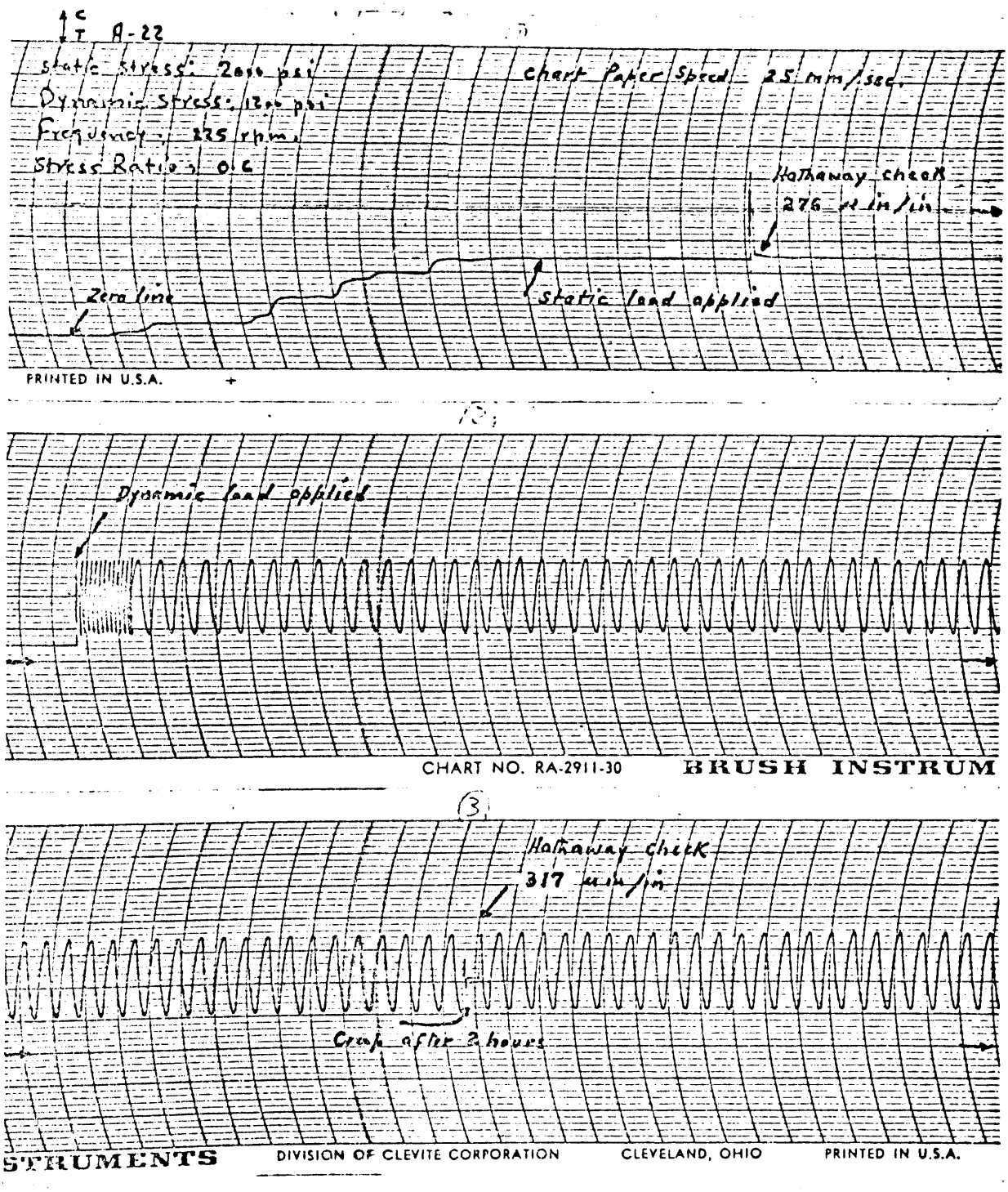

Figure G-5. Creep Behavior of Mortar Under a Superimposed Dynamic Load with a Stress Ratio A = 0.6.

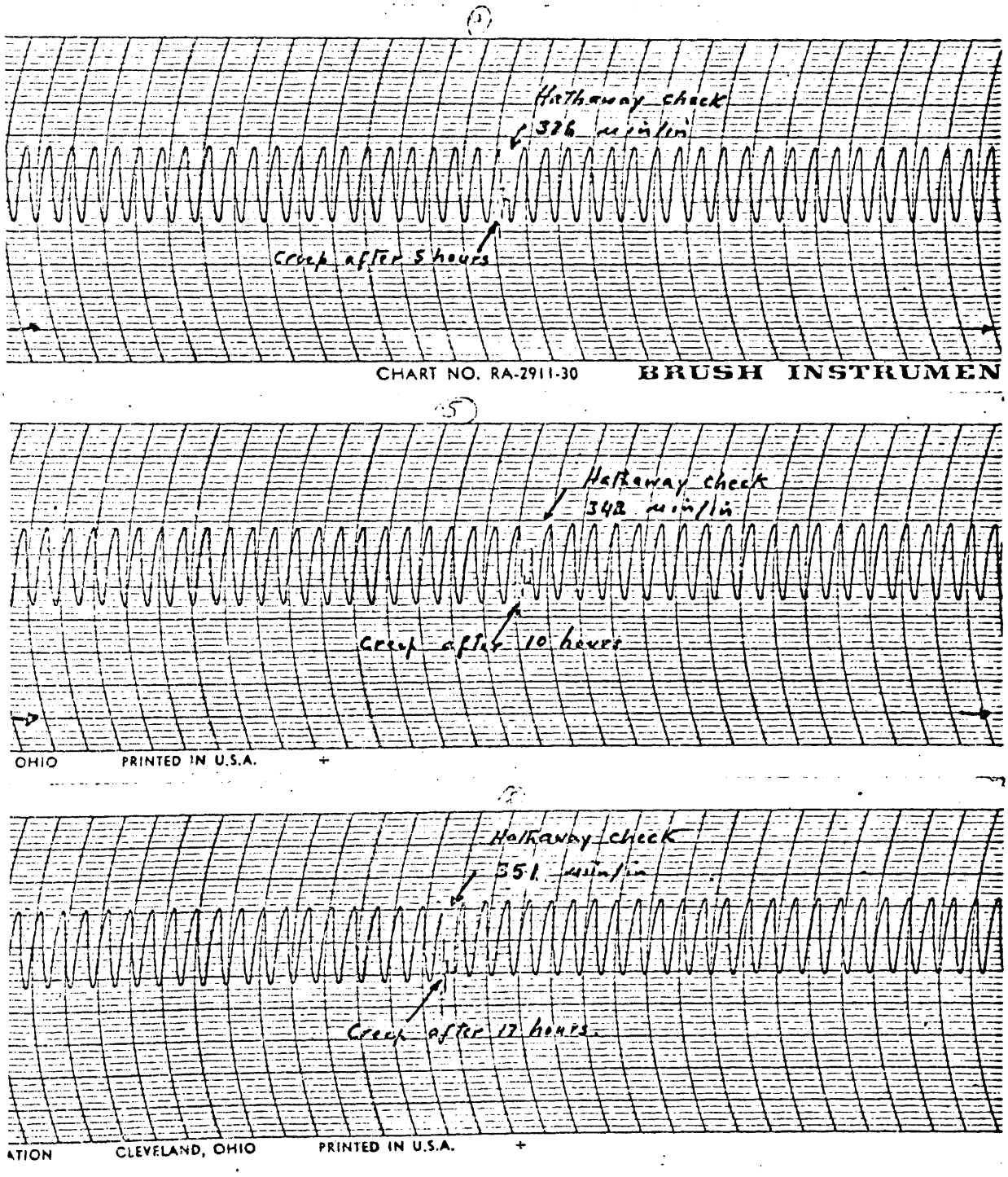

Figure G-5. (Cont.)

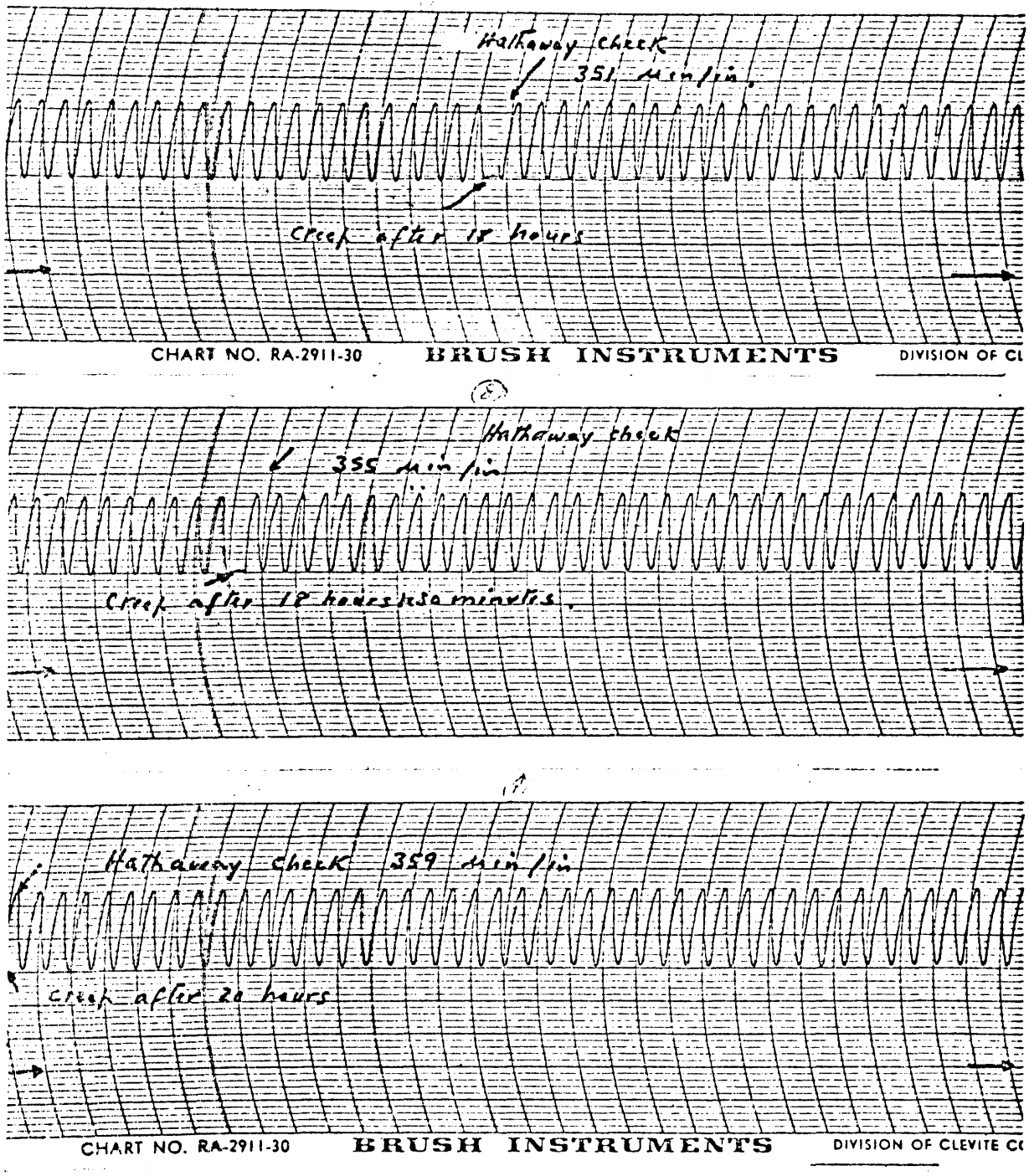

Figure G-5. (Cont.)

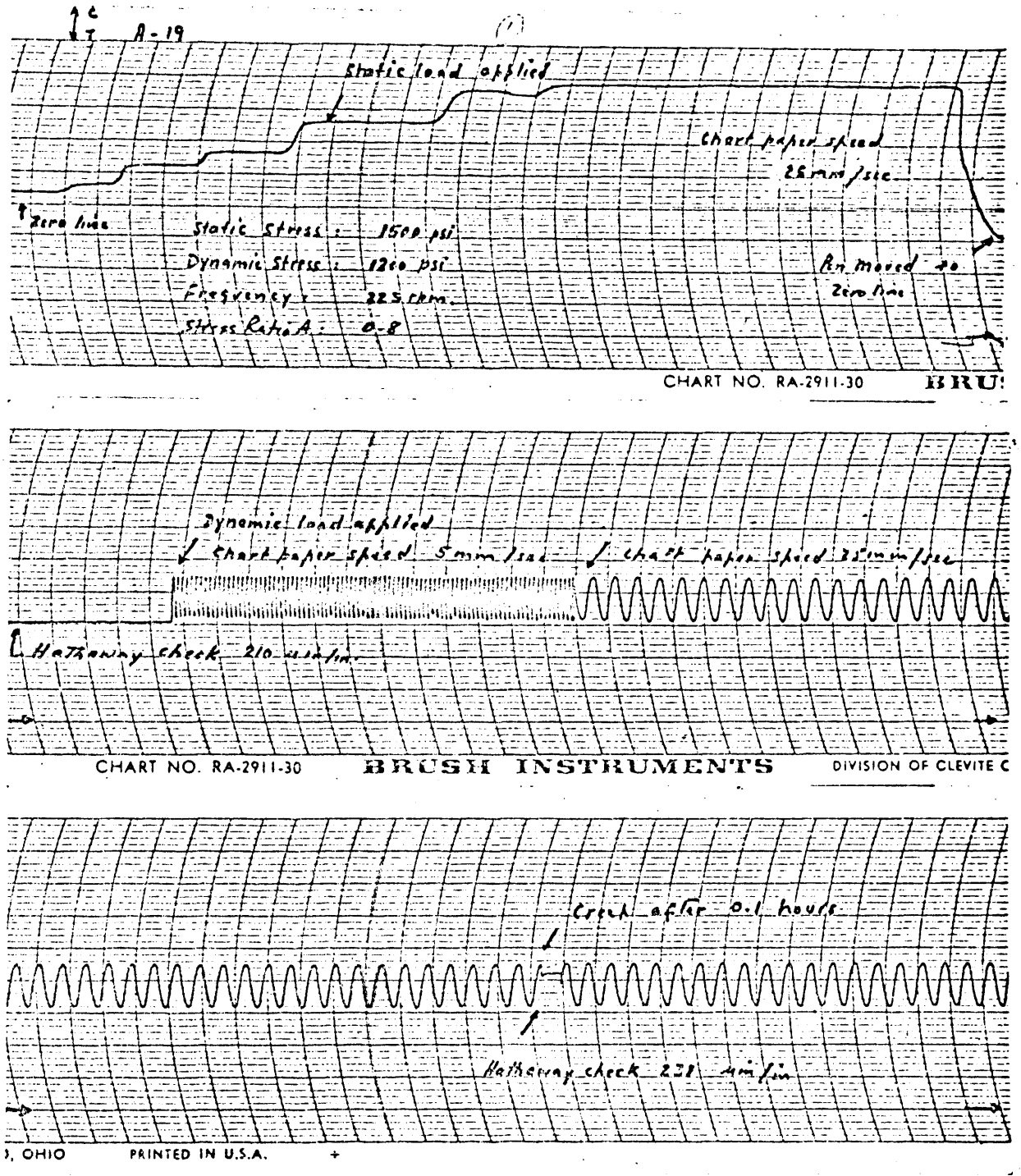

Figure G-6. Creep Behavior of Mortar Under a Superimposed Dynamic Load with a Stress Ratio A = 0.8.

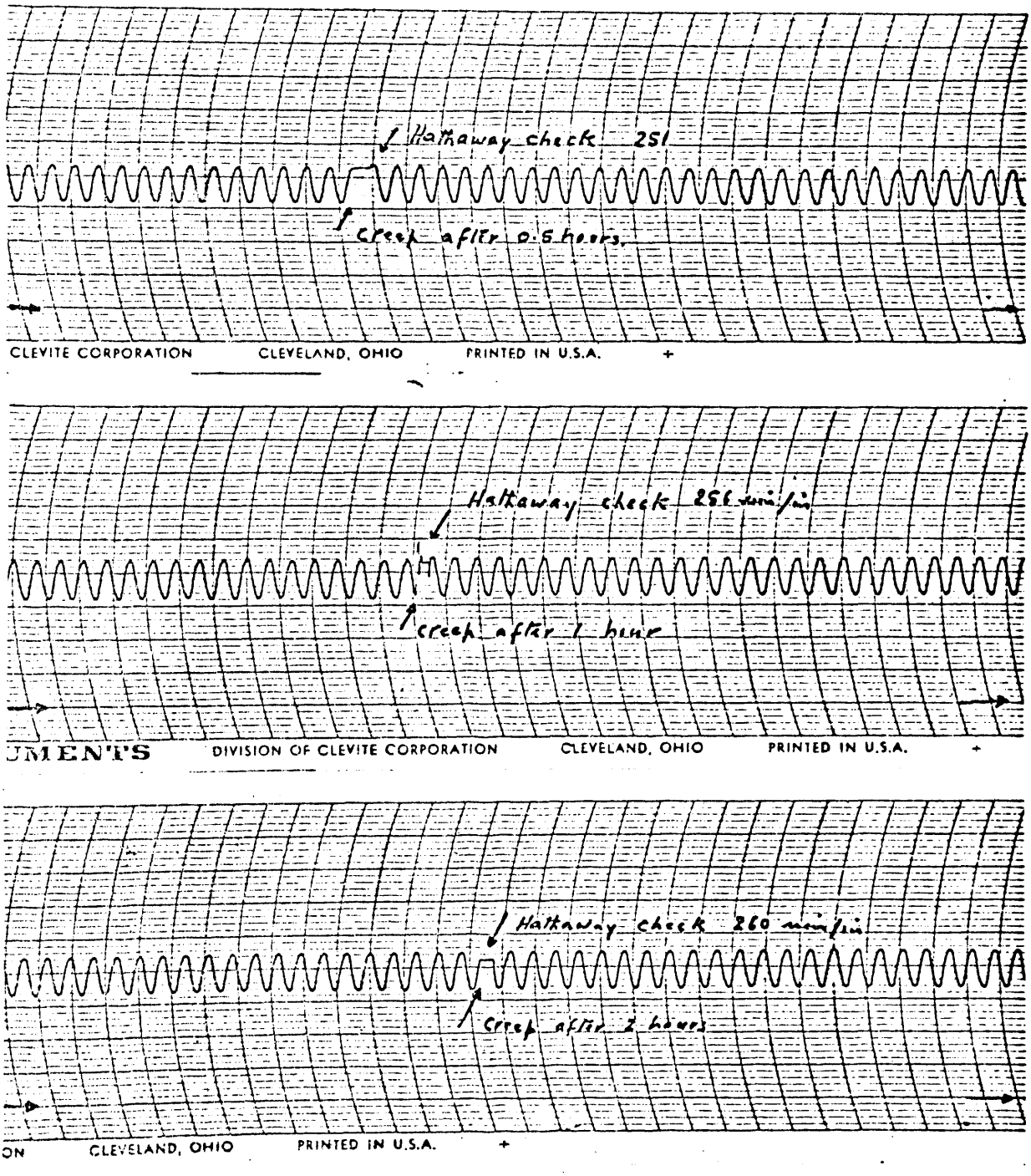

Figure G-6. (Cont.)

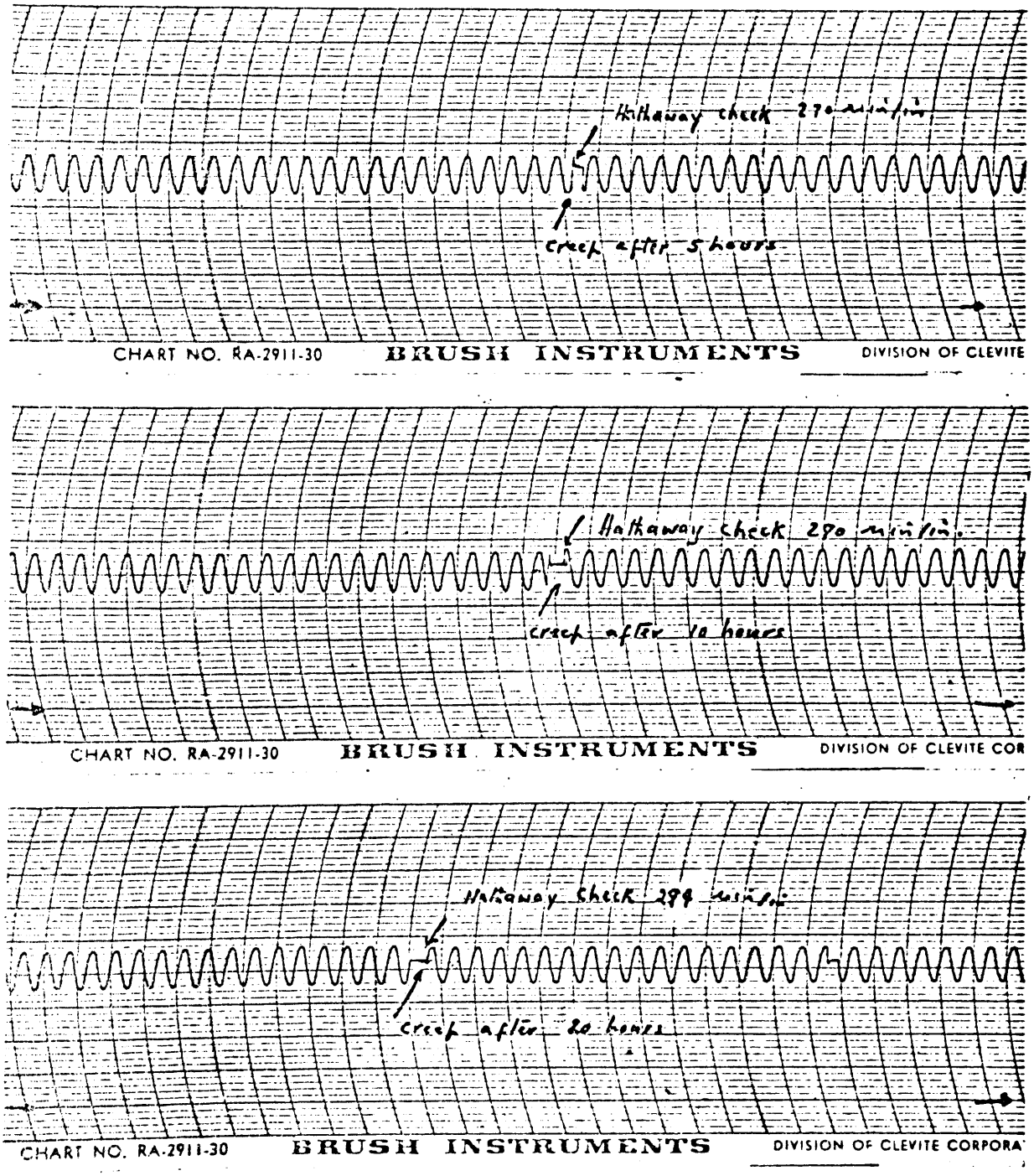

Figure G-6. (Cont.)

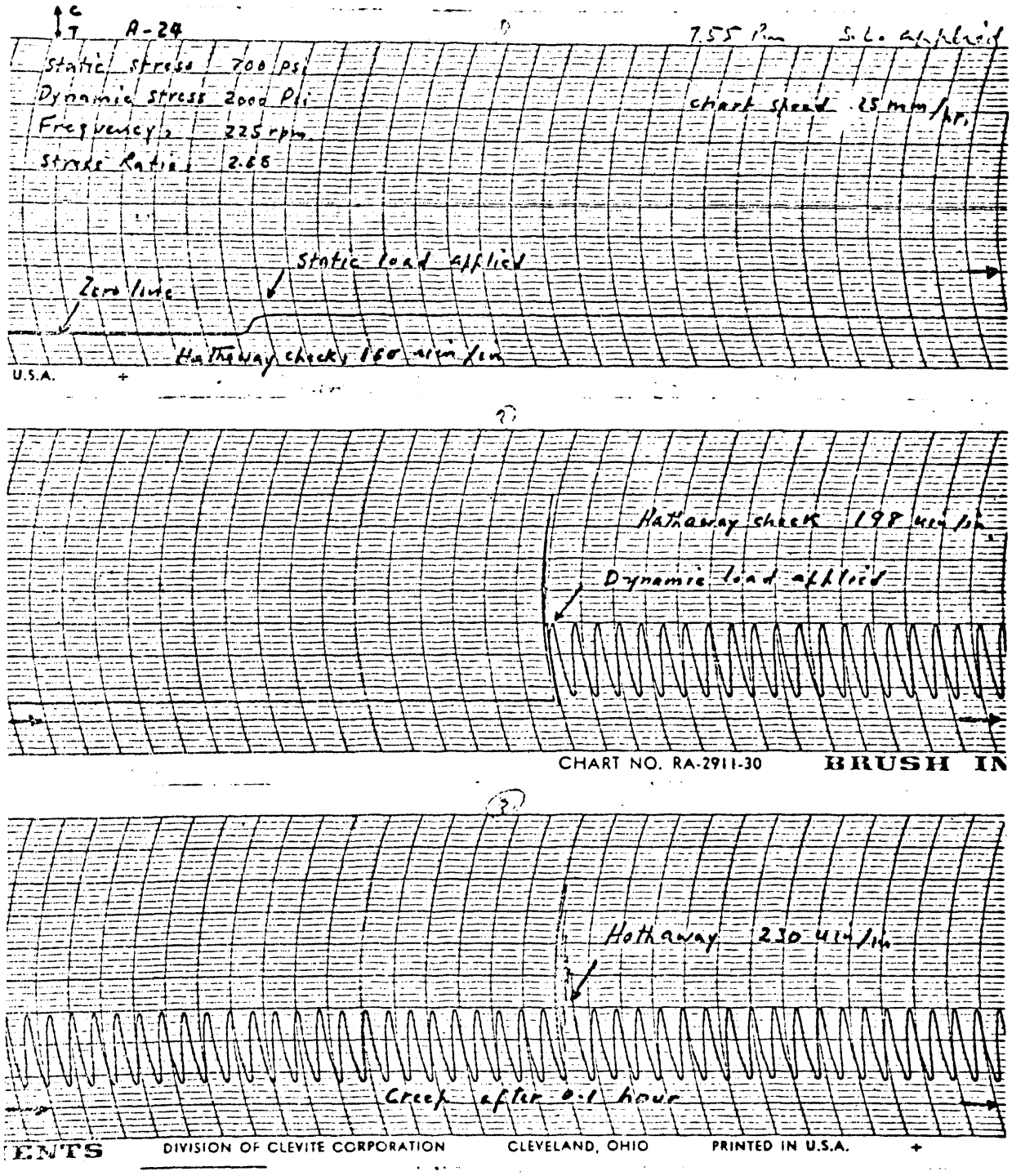

Figure G-7. Creep Behavior of Mortar Under a Superimposed Dynamic Load with a Stress Ratio A = 2.85.

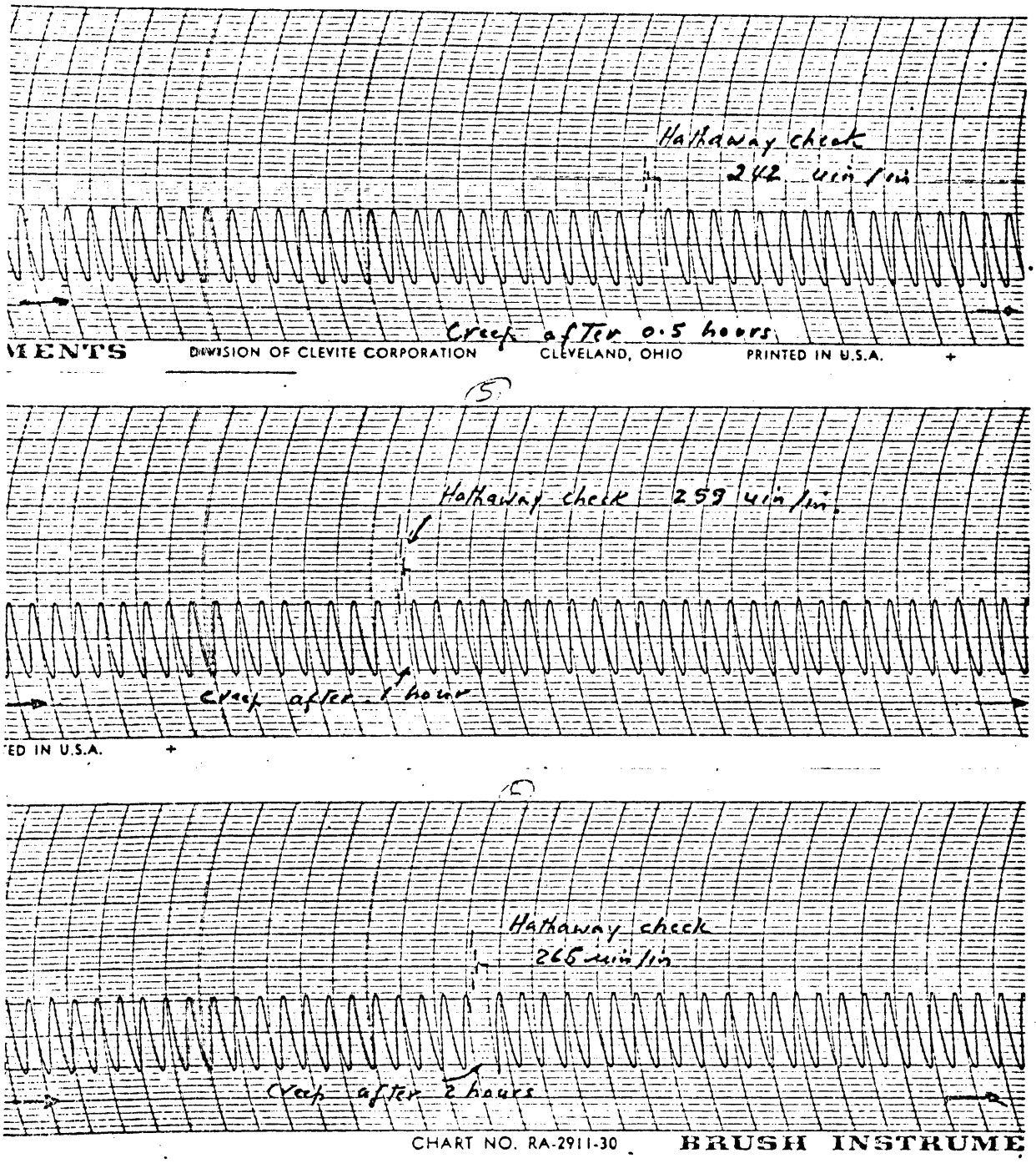

Figure G-7. (Cont.)

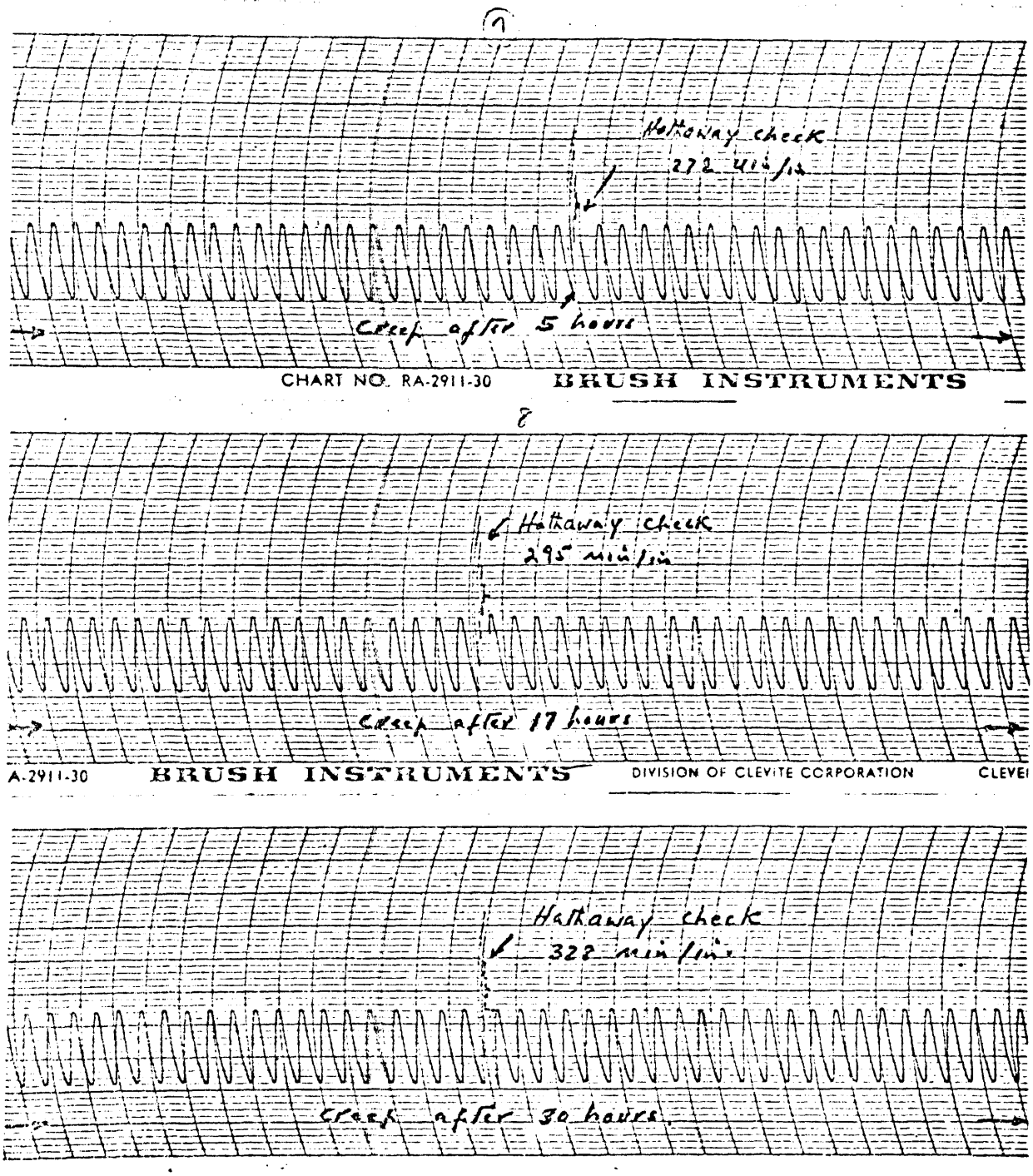

Figure G-7. (Cont.)

VITA

Ikram-ul-Haq Dar son of Dr. and Mrs. Abdul Haq was born on January 3rd, 1936 at Hydrabad Sind, West Pakistan.

He received his elementary and secondary education at various Government institutes in Pakistan. Upon graduating from Government High School, Sargodha, the author registered at Government College, Lahore, West Pakistan. He received an Intermediate Degree in Science in 1952 and studied History and Political Science at the same institution for an additional two years.

In 1954, he registered at the Government College of Engineering and Technology, Lahore, Pakistan from which he received a B.S. degree in Mining Engineering in 1957. He was appointed Lecturer at the College of Engineering and Technology the same year and was sent to the United States for higher studies under I.C.A. exchange program.

The author received a B.S. degree in Geology from Washington State University in 1959. In June 1959 he moved to Rolla, Missouri, where he enrolled as a M.S. candidate in Mining Engineering. He received his M.S. degree in Mining Engineering from Rolla in 1960.

He worked as a Lecturer in the Mining Engineering Department of the West Pakistan University of Engineering and Technology, at Lahore, from 1960 to 1964. In September 1964 he was promoted Assistant Professor and granted study leave

to enroll as a Ph.D. candidate at the University of Missouri at Rolla. He is married to former Tahira Aziz, and is a father of one child Ansar H. Dar.